

Fanuc robot r2000ib 165f maintenance manual

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Fanuc manuals, operator drives manuals, copys of cnc manuals pdfs and paper backed books.29 Jul 2014 FANUC CORPORATION. FANUC Robot R-2000iC . 210F. R-2000iC/210F. Allowable distance of load gravity center. Resources and networking for those who conduct or interpret meta-analyses related to any phenomenon that is gauged in multiple studies. Motion Controls Robotics has a full stock of spare parts available for replacement parts and maintenance. As a FANUC Authorized Servicing Integrator, we are able to get you all the parts you need at a discounted rate. We also have FANUC certified servicing engineers available for preventive maintenance and repair needs. *If you do not find the part you are searching for email customer service or call 419-334-5886 Below are search parameters to help narrow the results to find the part(s) you are needing for your FANUC robot. If you know the FANUC robot. If you know the FANUC specification number you can search by that as well. *If the table takes too long to load, refresh the browser and the table will load quickly. Enter Controller (Ex. R-30iB): Enter Robot Name (Ex. M-20iB): FANUC Specification Number: < > R-2000+B MECHANICAL UNIT MAINTENANCE MANUAL B-82235EN/08 • Original Instructions Thank you very much for purchasing FANUC Robot. Before using the Robot, be sure to read the "FANUC Robot SAFETY HANDBOOK (B-80687EN)" and understand the content. This manual can be used with controllers labeled R-30iA or R-J3iC. If you have a controller labeled R-J3iC, you should read R-30iA as R-J3iC throughout this manual may be reproduced in any form. • The appearance and specifications of this product are subject to change without notice. The products in this manual are controlled based on Japan's "Foreign Exchange and Foreign Trade Law". The export from Japan may be subject to an export license by the government of Japan. Further, re-export to another country may be subject to the license of the government of the country from where the product is re-export to another country from where the product is re-export to another country from where the product is re-export to another country from where the product is re-export to an export license of the government of Japan. the United States government. Should you wish to export or re-export these products, please contact FANUC for advice. In this manual, we endeavor to include all pertinent matters. There are, however, a very large number of operations that must not or cannot be performed, and if the manual contained them all, it would be enormous in volume. It is, therefore, requested to assume that any operations that are not explicitly described as being possible are "not possible". SAFETY PRECAUTIONS This chapter thereoutions which must be followed to ensure the safe use of the robot. Before using the robot, be sure to read this chapter thoroughly. For detailed functions of the robot operation, read the relevant operator's manual to understand fully its specification. For the safety of the operator and its peripheral equipment installed in a work cell. In addition, refer to the "FANUC Robot SAFETY HANDBOOK (B-80687EN)". 1 DEFINITION OF USER The personnel can be classified as follows. Operator: Turns the robot controller power on/off Starts the robot mean eres the robot inside the safety fence Maintenance (repair, adjustment, replacement) - Operator is not allowed to work in the safety fence. Programmer and maintenance engineer is allowed to work in the safety fence. To work inside the safety fence, the person must be trained on proper robot operation. During the operation, programming, and maintenance of your robotic system, the programmer, operator, and maintenance engineer should take additional care of their safety items. - Adequate clothes for the operation Safety items. - Adequate clothes for the operation Safety items. SAFETY NOTATIONS To ensure the safety of users and prevent damage to the machine, this manual indicates each precaution on safety with "WARNING" or "CAUTION" according to its severity. Supplementary information is indicated by "NOTE". Read the contents of each "WARNING", "CAUTION" and "NOTE" before using the robot. Symbol WARNING CAUTION NOTE 3 Definitions Used if hazard resulting in the death or serious injury of the user will be expected to occur if he or she fails to follow the approved procedure. Used if a hazard resulting in the minor or moderate injury of the user, or equipment damage may be expected to occur if he or she fails to follow the approved procedure. procedure. Used if a supplementary explanation not related to any of WARNING and CAUTION is to be indicated. Check this manual thoroughly, and keep it handy for the future reference. SAFETY OF THE USER (1) Have the robot system users attend the training courses held by FANUC. FANUC provides various training courses. Contact our sales office for details. (2) Even when the robot is stationary, it is possible that the robot is still in a ready to move state, and is waiting for a signal. In this state, the robot is regarded as still in motion. To ensure user safety, provide the system with an alarm to indicate visually or aurally that the robot is in motion. (3) Install a safety fence with a gate so that no user can enter the work area without passing through the gate. Install an interlocking device, a safety plug, and so forth in the safety gate so that the robot is stopped as the safety gate is opened. The controller stops the robot (Please refer to "STOP TYPE OF ROBOT" in "SAFETY PRECAUTIONS" for detail of stop type). For connection, see Fig. 3 (b). (4) Provide the peripheral equipment with appropriate earth (Class A, Class B, Class C, and Class D). (5) Try to install the peripheral equipment outside the robot operating space. (6) Draw an outline on the floor, clearly indicating the range of the robot operating space, including the tools such as a hand. (7) Install a mat switch or photoelectric switch on the floor with an interlock to a visual or aural alarm that stops the robot when a user enters the work area. (8) If necessary, install a safety lock so that no one except the user in charge can turn on the power of the robot. The circuit breaker installed in the controller is designed to disable anyone from turning it on when it is locked with a padlock. (9) When adjusting each peripheral equipment independently, be sure to turn off the power of the robot. s-2 SAFETY PRECAUTIONS B-82235EN/08 (10) Operators should be ungloved while manipulating the controller is designed to disable anyone from turning it on when it is operator panel or teach pendant. Operation with gloved fingers could cause an operation error. (11) Programs, system variables, and other information can be saved on memory card or USB memories. Be sure to save the data periodically in case the data is lost in an accident. (refer to Controller OPERATOR'S MANUAL.) (12) The robot should be transported and installed by accurately following the procedures recommended by FANUC. Wrong transportation or installation, the operation should be restricted to low speeds. Then, the speed should be gradually increased to check the operation of the robot. (14) Before the robot is started, it should be checked that no one is inside the safety fence. At the same time, a check must be made to ensure that there is no risk of hazardous situations. If detected, such a situation should be eliminated before the operation. (15) When the robot is used, the following precautions should be taken. Otherwise, the robot and peripheral equipment can be adversely affected, or workers can be severely injured. Avoid using the robot in an explosive environment. Avoid using the robot in an explosive environment. Avoid using the robot in an explosive environment. using the robot to carry a person or animal. Avoid using the robot as a stepladder. (Never climb up on or hang from the robot.) Outdoor (16) When connecting the peripheral equipment related to stop (safety fence etc.) and each signal (external emergency, fence etc.) of robot, be sure to confirm the stop movement and do not take the wrong connection. (17) When preparing footstep, please consider security for installation and maintenance work in high place according to Fig. 3 (c). Please consider footstep and safety belt mounting position. RP1 Pulsecoder RI/RO,XHBK,XROT RM1 Motor power/brake EARTH Safety fence Interlocking device and safety plug that are activated if the gate is opened. Fig. 3 (a) Safety fence and safety gate s-3 SAFETY PRECAUTIONS B-82235EN/08 WARNING When you close a fence, please confirm that there is not a person from all directions of the robot. Dual chain デュアルチェーン仕様の場合 Emergency stop board or Panel board (Note) EAS1 For the R-30iB, the R-30iB Mate Terminals EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board. EAS11 For the R-30iA Terminals EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS2 EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS2,EAS21 are provided on the emergency stop board or connector panel EAS1,EAS11,EAS1,EAS11,EAS1,EAS11 provided on the emergency stop board or in the connector panel of CRM65 (Open air type). Refer to the ELECTRICAL CONNCETIONS Chapter of CONNECTION of controller maintenance manual for details. FENCE2 Fig. 3 (b) Connection diagram for the signal of safety fence Hook for safety belt Fence Steps Trestle Pedestal for maintenance Fig. 3 (c) Pedestal for maintenance s-4 SAFETY PRECAUTIONS B-82235EN/08 3.1 SAFETY OF THE OPERATOR An operator refers to a person who turns on and off the robot system and starts a robot program from, for example, the operator panel during daily operation. Operators cannot work inside of the safety fence. (1) If the robot does not need to be operated, turn off the robot controller power or press the EMERGENCY STOP button during working. (2) Operate the robot system outside the operating space of the robot. (3) Install a safety fence or safety door to avoid the accidental entry of a person other than an operator in charge or keep operator out from the hazardous place. (4) Install the EMERGENCY STOP button within the operator's reach. The robot controller is designed to be connected to an external EMERGENCY STOP button. With this connection, the controller stops the robot operation (Please refer to "STOP TYPE OF ROBOT" in "SAFETY PRECAUTIONS" for detail of stop type) when the external EMERGENCY STOP button is pressed. See the diagram below for connection. Dual chain デュアルチェーン仕様の場合 External stop button 外部非常停止ボタン Emergency stop board or Panel board EES1 EES11 EES2 EES21 Single chain シングルチェーン仕様の場合 External stop button 外部非常停止ボタン Panel board EMGIN1 EMGIN2 (Note) Connect EES1 and EES11, EES2 and EES11 or EMGIN1 and EMGIN2 For the R-30iB Mate EES1, EES1, EES1, EES1, EES1, EES2, EES21 or EMGIN1, EMGIN2 are on the emergency stop board or in the connector panel of CRM65 (Open air type). Refer to the ELECTRICAL CONNCETIONS Chapter of CONNECTION of controller maintenance manual for Fig. 3.1 Connection diagram for external emergency stop button 3.2 SAFETY OF THE PROGRAMMER While teaching the robot, the operator must enter the robot operation area. the safety especially. The programmer must ensure (1) Unless it is specifically necessary to enter the robot operating space, carry out all tasks outside the operating space. (2) Before teaching the robot, check that the robot operating space to teach the robot, check the locations, settings, and other conditions of the safety devices (such as the EMERGENCY STOP button, the DEADMAN switch on the teach pendant) before entering the area of the safety fence as far as possible. If programming needs to be done inside the safety fence, the programmer should take the following precautions: Before entering the area of the safety fence, ensure that there is no risk of dangerous situations in the area. Be prepared to press the emergency stop button whenever necessary. Robot motions should be made at low speeds. Before starting programming, check the whole robot system status to ensure that no remote instruction to the peripheral equipment or motion would be dangerous to the user. s-5 SAFETY PRECAUTIONS B-82235EN/08 Our operator panel is provided with an emergency stop button and a key switch (mode switch) for selecting the automatic operation mode (AUTO) and the teach modes (T1 and T2). Before entering the inside of the safety gate is opened with the automatic operation mode set, the robot stops (Please refer to "STOP TYPE OF ROBOT" in SAFETY PRECAUTIONS for detail of stop type). After the safety gate is disabled. The programmer should understand that the safety gate is disabled and is responsible for keeping other people from entering the inside of the safety fence. Teach pendant is provided with a switch to enable/disable robot operation from teach pendant and DEADMAN switch as well as emergency stop button: Causes the stop of the robot (Please refer to "STOP TYPE OF ROBOT" in SAFETY PRECAUTIONS for detail of stop type) when pressed. (2) DEADMAN switch: Functions are different depending on the teach pendant enable/disable switch setting status. (a) Enable: Servo power is turned off and robot stops when the operator releases the DEADMAN switch is disabled. (Note) The DEADMAN switch is disabled. switch is provided to stop the robot when the operator releases the teach pendant or presses the pendant strongly in case of emergency. The R-30iB/R-30iB Mate/R-30iA/R-30iA Mate employs a 3-position DEADMAN switch, which allows the robot to operate when the 3-position DEADMAN switch is pressed to its intermediate point. When the operator releases the DEADMAN switch or presses the switch strongly, the robot stops immediately. The operator's intention of starting teaching is determined by the controller through the dual operator should make sure that the robot could operate in such conditions and be responsible in carrying out tasks safely. Based on the risk assessment by FANUC, number of operator panel, and peripheral equipment interface send each robot start signal. However the validity of each signal changes as follows depending on the mode switch and the DEADMAN switch of the operator panel, the teach pendant enable switch and the remote condition on the software. For the R-30iB/R-30iB Mate/R-30iA Controller or CE or RIA specification of the R-30iA Mate Controller Mode Teach pendant enable switch Software remote condition Local Remote Local Off Remote Local On Remote T1, T2 mode Local Off Remote T1, T2 mode: DEADMAN switch is effective. On AUTO mode Teach pendant Operator panel Peripheral equipment Not allowed Not allowed to start Not allowed to start Not allowed Not allowed Not allowed to start Not allowed Not allo Not allowed Not allowe start Not allowed Not allowed Not allowed Not allowed to start s-6 SAFETY PRECAUTIONS B-82235EN/08 (6) (Only when R-30iB/R-30iB Mate /R-30iA Mate controller is selected.) To start the system using the operator panel, make certain that nobody is in the robot operating space and that there are no abnormal conditions in the robot operation space. (7) When a program for at least one operation cycle in the single step mode at low speed. (b) Run the program for at least one operation cycle in the continuous operation mode at low speed. (c) Run the program for one operation cycle in the continuous operation mode at the intermediate speed and check that no abnormalities occur due to a delay in timing. (d) Run the program for one operation cycle in the continuous operation generation trouble. (e) After checking the completeness of the program through the test operation above, execute it in the automatic operation mode. (8) While operation mode. (8) While operation mode, the teach pendant operator must leave the safety fence. 3.3 SAFETY OF THE MAINTENANCE ENGINEER For the safety of maintenance engineer personnel, pay utmost attention to the following. (1) During operation, never enter the robot or the system, are kept with their power-on during maintenance operations. Therefore, for any maintenance operation, the robot or the system should be put into the power-off state. If necessary, a lock should be in place in order to prevent any other person from turning on the robot and/or the system. In case maintenance needs to be executed in the power is on, press the emergency stop button on the operator box or operator panel, or the teach pendant before entering the range. The maintenance work is in progress and be careful not to allow other people to operate the robot carelessly. (4) When entering the area enclosed by the safety fence, the worker must check the whole robot system in order to make sure no dangerous situations exist. In case the worker needs to enter the safety area whilst a dangerous situation exists, extreme care must be taken, and whole robot system is started, the supply pressure should be shut off and the pressure in the piping should be reduced to zero. (6) Before the start of maintenance work, check that the robot and its peripheral equipment are all in the normal operating space. (8) When you maintain the robot alongside a wall or instrument, or when multiple users are working nearby, make certain that their escape path is not obstructed. (9) When a tool is mounted on the robot, or when any movable device other than the robot is installed, such as belt conveyor, pay careful attention to its motion. (10) If necessary, have a user who is familiar with the robot system stand beside the operator panel and observe the work being performed. If any danger arises, the user should be ready to press the EMERGENCY STOP button at any time. (11) When replacing a part, please contact your local FANUC representative. If a wrong procedure is followed, an accident may occur, causing damage to the robot and injury to the user. (12) When replacing or reinstalling components, take care to prevent foreign material from entering the system. (13) When handling each unit or printed circuit breaker to protect against electric shock. If there are two cabinets, turn off the both circuit breaker. s-7 SAFETY PRECAUTIONS B-82235EN/08 (14) A part should be replaced with a part recommended by FANUC. If other parts are used, malfunction or damage would occur. Especially, a fuse that is not recommended by FANUC should not be used. Such a fuse may cause a fire. (15) When restarting the robot system after completing maintenance work, make sure in advance that there is no person in the operating space and that the robot and the peripheral equipment are not abnormal. (16) When a motor or brake is removed, the robot arm should be supported with a crane or other equipment beforehand so that the arm would not fall during the removal. (17) Whenever grease is spilled on the floor, it should be removed as quickly as possible to prevent dangerous falls. (18) The following parts are heated. If a maintenance user needs to touch such a part in the heated state, the user should wear heat-resistant gloves or use other protective tools. Servo motor Inside the controller Reducer Gearbox Wrist unit (19) Maintenance should be done under suitable light. Care must be taken that the light would not cause any danger. (20) When a motor, reducer, or other heavy load is handled, a crane or other equipmenthould be used to protect maintenance workers from excessive load. Otherwise, the maintenance workers from excessive load. Otherwise, the maintenance workers from excessive load is handled, a crane or other equipmenthould be used to protect maintenance workers from excessive load. would be adversely affected. In addition, a misstep can cause injury to the worker. (22) When performing maintenance work in high place, secure a footstep and wear safety belt. (23) After the maintenance work in high place, secure a footstep and wear safety belt. is replaced, all bolts and other related components should put back into their original places. A careful check must be given to ensure that no components are missing or left not mounted. (25) In case robot motion is required during maintenance, the following precautions should be taken : Foresee an escape route. And during the maintenance motion itself, monitor continuously the whole robot system so that your escape route will not become blocked by the robot, or by peripheral equipment. Always pay attention to potentially dangerous situations, and be prepared to press the emergency stop button whenever necessary. (26) The robot should be periodically inspected. (Refer to the robot mechanical manual and controller maintenance manual.) A failure to do the periodical inspection can adversely affect the performance or service life of the robot and may cause an accident (27) After a part is replaced, a test execution should be given for the robot according to a predetermined method. (See TESTING section of "Controller operator's a test execution should be given for the robot according to a predetermined method.) A failure to do the periodical inspection can adversely affect the performance or service life of the robot according to a test execution should be given for the robot according to a predetermined method. manual".) During the test execution, the maintenance worker should work outside the safety fence. s-8 SAFETY PRECAUTIONS B-82235EN/08 4 4.1 SAFETY OF THE TOOLS AND PERIPHERAL EQUIPMENT PRECAUTIONS IN PROGRAMMING (1) Use a limit switch or other sensor to detect a dangerous condition and, if necessary, design the program to stop the robot when the sensor signal is received. (2) Design the program to stop the robot itself is normal. (3) For a system in which the robot and its peripheral equipment are in synchronous motion, particular care must be taken in programming so that they do not interfere with each other. (4) Provide a suitable interface between the robot and its peripheral equipment so that the robot can detect the states of all devices in the system and can be stopped according to the states. 4.2 PRECAUTIONS FOR MECHANISM (1) Keep the component cells of the robot system clean water, and dust. (2) Don't use unconfirmed liquid for cutting fluid and cleaning fluid. (3) Adopt limit switches or mechanical stoppers to limit the robot motion, and avoid mechanical unit cables. Failure to follow precautions may cause problems. Use mechanical unit. In the case of the model that ave required user interface. Do not add user cable or hose to inside of the mechanical unit. In the case of the model that ave required user interface. cable is exposed, please do not perform remodeling (Adding a protective cover and fix an outside cable more) obstructing the behavior of the outcrop of the cable. When installing user peripheral equipment on the robot mechanical unit, please pay attention that the device does not interfere with the robot itself. (5) The frequent power-off stop for the cable. robot during operation causes the trouble of the robot. Please avoid the system construction that power-off stop would be operated routinely. (Refer to bad case example.) Please perform power-off stop after reducing the speed of the robot and stopping it by hold stop or cycle stop when it is not urgent. (Please refer to "STOP TYPE OF ROBOT" in "SAFETY PRECAUTIONS" for detail of stop type.) (Bad case example) Whenever poor product is generated, a line stops by emergency stop and power-off of the robot during operation. An operator pushes the emergency stop button frequently, and a line stops. An area sensor or a mat switch connected to safety signal operates routinely and power-off stop is regularly incurred for the robot. Power-off stop is regularly incurred due to an inappropriate setting for Dual Check Safety (DCS). (6) Power-off stop is executed when collision detection alarm (SRVO 050) etc. occurs. Please try to avoid unnecessary power-off stops. It may cause the trouble of the robot, too. So remove the causes of the alarm. (7) In case of washing booth. Please refer to piping and wiring to the end effector chapter of mechanical unit operator's manual about purge air urge pressure. s-9 SAFETY PRECAUTIONS 5 5.1 B-82235EN/08 SAFETY OF THE ROBOT MECHANICAL UNIT PRECAUTIONS IN OPERATION (1) When operator can manage the robot in any eventuality. (2) Before pressing the jog key, be sure you know in advance what motion the robot will perform in the jog mode. 5.2 PRECAUTIONS IN PROGRAMMING (1) When the operating spaces of robots overlap, make certain that the motions of the robots do not interfere with each other. (2) Be sure to specify the predetermined work origin in a motion program for the robot and program the motion so that it and terminates at the origin. Make it possible for the operator to easily distinguish at a glance that the robot motion has terminated. 5.3 PRECAUTIONS FOR MECHANISMS Keep the robot operation area clean, and operate the robot in an environment free of grease, water, and dust. 5.4 PROCEDURE TO MOVE ARM WITHOUT DRIVE POWER IN EMERGENCY OR ABNORMAL SITUATIONS (1) For emergency or abnormal situations (e.g. persons trapped in or pinched by the robot), brake release unit can be used to move the robot axes without drive power. Please order following unit and cable. Name Brake release unit can be used to move the robot axes without drive power. (10m) (AC100-115V or AC200-240V No power plug) (*) These do not support CE marking. (2) Please make sure that adequate numbers of brake release units are available and readily accessible for robot system before installation. (3) Regarding how to use brake release units are available and readily accessible for robot system before installation. PRECAUTIONS B-82235EN/08 CAUTION Robot systems installed without adequate number of brake release units or similar means are not in compliance with EN ISO 10218-1 and the Machinery Directive and therefore cannot bear the CE marking. WARNING Robot arm would fall down by releasing its brake because of gravity. Especially because spring balancer is used for J2-axis, it is hard to predict J2-arm movement by the condition of Robot posture and end effector. Therefore it is strongly recommended to take adequate measures such as hanging Robot arm by a crane before releasing a brake. (There is no balancer for R-2000iB/170CF, 150U, 220U and 165CF) In case of releasing motor brake Method of supporting robot arm Eyebolt (M10) 2pcs 2 slings ? Eyebolt (M10) 1pc 1 leverblock Eyebolt (M10) 1pc 1 leverblock Eyebolt (M10) 1pc 1 leverblock Eyebolt (M12) 1pc 1 leverblock ? Unpredictable Fig. 5.4 (a) Arm operation by the release of J2-axis motor brake and measures (R-.85L/250F/165R/200R/100P/210WE/125L/175L/100H) s-11 SAFETY PRECAUTIONS B-82235EN/08 In case of releasing motor brake Method of supporting robot arm Eyebolt (M10) 2pcs 2 slings Fall down Fig. 5.4 (b) Arm operation by the release of J3-axis motor brake and measures (R /210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H) Fall down Fall down Supporting method of arm for R-2000iB/170CF(loor mount) Supporting method of arm for R-2000iB/170CF(loor mount) Fig. 5.4 (c) Arm operation by the release of J2,J3-axis motor brake and F/150U/220U/165CF) s-12 SAFETY PRECAUTIONS B-82235EN/08 6 SAFETY OF THE END EFFECTOR 6.1 PRECAUTIONS IN PROGRAMMING (1) To control the pneumatic, hydraulic and electric actuators, carefully consider the necessary time delay after issuing each control command up to actual motion and ensure safe control. (2) Provide the end effector with a limit switch, and control the robot system by monitoring the state of the end effector. 7 STOP TYPE OF ROBOT The following IEC 60204-1) Servo power is turned off when the robot is moving, and the path of the deceleration is uncontrolled. The following processing is performed at Power-Off stop. An alarm is generated and servo power is turned off. The robot during operation can cause failures of the robot. Avoid system designs that require routine or frequent Power-Off stop conditions. Controlled stop, and servo power is turned off. The following processing is performed at Controlled stop. The alarm "SRVO-199 Controlled stop" occurs along with a decelerated stop. Execution of the program is paused. An alarm is generated and servo power is turned off. Hold (Category 2 following IEC 60204-1) The robot is decelerated until it stops, and servo power remains on. The following processing is performed at Hold. time of Controlled stop are longer than the stopping distance and stopping time of Power-Off stop. A risk assessment for the whole robot system, which takes into consideration the increased stopping distance and stopping time, is necessary when Controlled stop is used. When the emergency stop button is pressed or the FENCE is open, the stop type of robot is Power-Off stop or Controlled stop. The configuration of stop type for each situation is called stop pattern. The stop pattern is different according to the controller type or option configuration. s-13 SAFETY PRECAUTIONS B-82235EN/08 There are the following 3 Stop patterns. Stop pattern A B C P-Stop: -: Mode Emergency stop button External Emergency stop FENCE open SVOFF input Servo disconnect P-Stop P Stop P-Stop AUTO T1 T2 AUTO T1 T2 AUTO T1 T2 AUTO T1 T2 Power-Off stop Controlled stop by E-Stop A (*) C (*) (A05B-2600-J570) (*) R-30iB/R-30iB Mate does not have serve disconnect. R-30iB/R-30iB Mate does not have SVOFF input. Option Standard (Single) Standard Stop type set (Stop pattern C) (A05B-2500-J570) R-30iA Mate RIA Standard does not have serve disconnect. (**) R-30iA Mate RIA Standard does not have serve disconnect, and the stop type of SVOFF input is Power-Off stop. The stop pattern of the controller is displayed in "Stop pattern" line in software version screen. "Controlled stop by E-Stop" option When "Controlled stop by E-Stop" (A05B-2600-J570) option (For the R-30iA/R-30iA Mate, it is Stop type set (Stop pattern C) (A05B-2500-J570)) is specified, the stop type is Power-Off stop which is the normal operation of the system. Alarm SRVO-001 Operator panel E-stop SRVO-002 Teach pendant E-stop SRVO-007 External emergency stops SRVO-194 Servo disconnect SRVO-218 Ext.E-stop/Servo Disconnect SRVO-408 DCS SSO Ext Emergency stop is pressed. External emergency stop is pre EES21) is open. (R-30iA/R-30iB/R-30iB/R-30iB Mate controller) Servo disconnect input (SD4-SD41, SD5-SD51) is open. (R-30iA controller) In DCS Safe I/O connect function, SSO[3] is OFF. In DCS Safe I/O connect function, SSO[4] is OFF. s-14 SAFETY PRECAUTIONS B-82235EN/08 Controlled stop, the robot is stopped on the program path. In Controlled stop, physical impact is less than Power-Off stop. This function is effective for a system where the robot can interfere with other devices if it deviates from the program path. In Controlled stop, physical impact is less than Power-Off stop. function is effective for systems where the physical impact to the mechanical unit or EOAT (End Of Arm Tool) should be minimized. The stopping distance and time of Controlled stop is longer than the those of Power-Off stop, depending on the robot model for the data of stopping distance and time. For the R-30iA or R-30iA Mate, this function is available only in CE or RIA type hardware. When this option is loaded, this function and Speed Check functions is not affected by the loading of this option. WARNING The stopping distance and time of Controlled stop are longer than those of Power-Off stop. A risk assessment for the whole robot system which takes into consideration the increased stopping distance and stopping distance and stopping time, is necessary when this option is loaded. 8 (1) WARNING & CAUTION LABEL Greasing and degreasing label 1) 必ず排脂口を開けて給脂して下さい。 Openthe grease outletter 必须在排脂口打开的状态下供脂。 2) 手動式ポンプを使用して給脂を行って 下さい。 Use a hand pump at greasing. 请使用手动式供脂泵进行供脂。 3) 必ず指定グリスを使用して下さい。 Use designated grease at greasing. 必须使用指定的润滑脂。 Fig. 8 (a) Greasing and degreasing label Description When greasing and degreasing, observe the instructions indicated on this label. 1) When grease. CAUTION See Chapter 2 PERIODIC MAINTENANCE for explanations about specified grease, the grease amount, and the locations of grease and degrease outlets for individual models. s-15 SAFETY PRECAUTIONS (2) B-82235EN/08 Disassembly prohibitive label Fig. 8 (b) Disassembly prohibitive label Fig. 8 (b) Disassembly prohibitive label is affixed only to the balancer). (3) Step-on prohibitive label Fig. 8 (c) Step-on prohibitive label Description Do not step on or climb the robot or controller as it may adversely affect the robot or controller as it may adversely a warning label Description Be cautious about a section where this label is affixed, as the section generates heat. If you have to inevitably touch such a section when it is hot, use a protective tool such as heat-resistant gloves. (5) Transportation label >2500kg 1000kg x4 >630kg x4 Fig. 8 (e) Transportation label (R-0WE/125L/175L/100H/150U/220U) s-17 SAFETY PRECAUTIONS B-82235EN/08 > 2500kg 2500kg 2500kg x4 Fig. 8 (f) Transportation label (R-2000iB/185L) > 2500kg 1000kg x4 > 630kg x4 Fig. 8 (g) Transportation label (R-2000iB/165R/200R/100P) > 2500kg 2500kg > 1000kg x4 > 630kg x4 Fig. 8 (h) label (R-2000iB/170CF) s-18 SAFETY PRECAUTIONS B-82235EN/08 > 2500kg 2500kg > 1000kg X4 > 630kg X4 Fig. 8 (i) Transportation label (R-2000iB/165CF) Description When transportation label (R-2000iB/165CF) Description Description When transportation label (R-2000iB/165CF) Description (R-2000iB/165CF) Description (R-2000iB/165CF) Description (R-2000iB/165CF) Description (R-2000iB/165CF) Description (R-2000iB/165CF) Description (R-2000iB/165CF) Descrip Keep the total weight of the robot to be transported to within 2200 kg, because the load capacity of the forklift bracket (option) is 5390 N (550 kgf). Using a crane with a load capacity of 9800 N (1000 kgf) or greater. Use at least four eyebolts with each load capacity of 6174 N (630 kgf) or greater. CAUTION Transportation labels are model-specific. Before transportation label affixed to the J2 base side. See Subsection 1.1 TRANSPORTATION of OPERATOR'S MANUAL (B-82234EN) for explanations about the posture a specific model should take when it is transported. s-19 SAFETY PRECAUTIONS (6) B-82235EN/08 Balancer replacement label 150kg J2=0° Fig. 8 (j) Balancer replacement label (R-2000iB/165F/210F/185L/250F/210WE/125L/175L/100H) 300kg J2=-90° Fig. 8 (k) Balancer replacement label (R-2000iB/165R/200R/100P) Description When replacing the balancer, observe the instructions indicated on this label. The eplacement label indicates the following: While replacing the balancer, keep the J2-axis at 0 for the R-2000iB/165F/210F/185L/250F /210WE/125L/175L/100H and keep the J2-axis at -90 for the R-2000iB/165F/210F/185L/250F /210WE/125L/175L/100H, the mass of the balancer is 150 kg. For the R-2000iB/165F/210F/185L/250F /210WE/125L/175L/100H and keep the J2-axis at -90 for the R-2000iB/165F/210F/185L/250F /210WE/125L/175L/100H and keep the J2-axis at -90 for the R-2000iB/165F/210F/185L/250F /210WE/125L/175L/100H and keep the J2-axis at -90 for the R-2000iB/165F/210F/185L/250F /210WE/125L/175L/100H and keep the J2-axis at -90 for the R-2000iB/165F/210F/185L/250F /210WE/125L/175L/100H and keep the J2-axis at -90 for the R-2000iB/165F/210F/185L/250F /210WE/125L/175L/100H. -180DEG 0DEG J5-axis rotation center 3045 J5轴旋转中心 Motion range of J5-axis rotation center 370 J5轴旋转中心 动作范围 2655 1919 MAX. PAYLOAD : 165kg Fig. 8 (l) Operating space and payload label (example of R-2000iB/165F) (8) Transportation prohibitive label (When transport equipment option is specified.) アイボ ルト を横引 しないこと Do not pull eyebolt sideways 禁止 横向拉拽吊环螺钉 Fig. 8 (m) Transportation caution label (for eyebolt option) Description Do not pull eyebolt sideways when transporting the robot. s-21 SAFETY PRECAUTIONS B-82235EN/08 アイボルトを横引 しないこと 輸送部材に手ェーン などを掛けないこと Do not pull eyebolt sideways Do not have impact on this part Do not chain, pry, or strap on this part 禁止横向拉拽吊环螺钉 禁止撞击搬运用部件 禁止在搬运用部件 上使用锁链 等物品固定或者搬运机器人 Fig. 8 (n) Transportation prohibitive label (for transport equipment option) Description Keep the following in mind when transport equipment option) Description Keep the following in mind when transportation prohibitive label (for transport equipment option) Description Keep the following in mind when transport equipment option) Description Keep the following in mind when transport equipment option) Description Keep the following in mind when transport equipment option) Description Keep the following in mind when transport equipment option) Description Keep the following in mind when transport equipment option) Description Keep the following in mind when transport equipment option) Description Keep the following in mind when transport equipment option) Description Keep the following in mind when transport equipment option) Description Keep the following in mind when transport equipment option) Description Keep the following in mind when transport equipment option) Description Keep the following in mind when transport equipment option) Description Keep the following in mind when transport equipment option) Description Keep the following in mind when transport equipment option) Description Keep the following in mind when transport equipment option) Description Keep the following in mind when transport equipment option (for transport equipment option) Description (for transpo of the forklift from having impact on a transport equipment Do not thread a chain or the like through a transport equipment. Transportation caution label (When transport equipment option A05B-1329-H075 is specified.) 1) ロボット設置後、輸送部材は必ず 取り外して下さい。 Remove the transport equipment after installing the robot . 安装完机器人之 后,请务必将搬运用部件拆下。 2) 運搬する際は必ずワークを 取り外して下さい。 Remove all loads when transporting the robot. (Wrist and arm) 搬运时请务必将工件拆下。 3) 必ずマニュアルに記載の姿勢にて 運搬して下さい。 Always place the robot in shipping position (refer to the manual) when transporting the robot. 务必按照说明书上记载的姿势搬运机器人。 High voltage attention label(R-2000iB/210WE)内部高電圧注意 CAUTION HIGH VOLTAGE INSIDE 注意内部有高电压 ファナックのサービスマン以外は このカバーを開けてはいけません。 Do not open this cover except the repair person of FANUC. 除了发那科的维修人员,禁止打开此盖。 Fig. 8 (p) High voltage attention label Description Do not open this cover except the (11) repair person of FANUC. Battery case attention label(R-2000iB/210WE) Fig. 8 (q) Battery case cover attention label Description Battery case is inside. For replacing batteries, open this, you should replace bolts and a gasket with new ones. 151216 s-23 PREFACE B-82235EN/08 PREFACE This manual explains about nance procedures for the following robot mechanical units: Model name FANUC Robot R-2000iB/165F FANUC ANUC Robot R-2000iB/210WE FANUC Robot R-2000iB/125L FANUC Robot R-2000iB/175L FANUC Robot R-2000iB/165CF Mechanical unit specification No. Max. payload A05B-1329-B201 A05B-1329-B205 A05B-1329-B201 A05B-1329-B205 A05B-1329-B201 A05B-1329-B205 A05B-1329 unit specification number is affixed in the following position. Before reading this manual, verify the specification number of the mechanical unit specification number p-1 PREFACE B-82235EN/08 Table 1) (1) CONTENTS MODEL NAME LETTERS FANUC Robot R-2000iB/165F FANUC Robot R-2000iB/210F FANUC Robot R-2000iB/185L FANUC Robot R-2000iB/250F FANUC Robot R-2000iB/100P OPERATOR'S MANUAL B-83284EN-2 Spot Welding Function OPERATOR'S MANUAL B-83284EN-5 Servo Gun FUN designer Topics: Safety items for robot system design, operation, maintenance Intended readers : Operator, Programmer, Maintenance engineer, System designer, System designe Topics : Installation, Start-up, Connection, Maintenance Use : Installation, Start-up, Connection, Maintenance Intended readers : Operator, Programming, Start-up, Interfaces, Alarms Use : Robot operation, Teaching, System design Intended readers Maintenance engineer, System designer Topics: Installation, Start-up, Connection, Maintenance Use: Installation, Start-up, Connection, Maintenance This manual uses onnection cable between robot and controller Robot mechanical unit Terms in this manual Robot connection cable Mechanical unit p-3 TABLE OF CONTENTS B-82235EN/08 TABLE OF CONTENTS SAFETY PRECAUTIONSp-1 1 CHECKS AND MAINTENANCE . 1 1.1.1 1.1.2 1.2 CHECK POINTS 1 1.1 PERIODIC MAINTENANCE . 5 1.2.1 1.2.2 1.2.3 1.2.4 1.2.5 1.3 2 2.2 2.3 2.4 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE) 17 REPLACING THE GREASE OF THE DRIVE MECHANISM (3-YEAR 16 REPLACING THE BATTERIES (1.5-YEAR (5760 HOURS) PERIODIC MAINTENANCE) 20 PROCEDURE FOR RELEASING REMAINING PRESSURE FROM THE GREASE BATH 29 BACKLASH MEASUREMENT 51 4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9 4.10 5 MAINTENANCE TOOLS 11 TROUBLESHOOTING .. 29 3.1 3.2 4 Confirmation of Oil Seepag 5 Confirmation of the Air Control Set or Air Purge Kit 7 Check of Fixed Mechanical Stopper and Adjustable Mechanical Stopper 9 Confirm There is No Breakage on Purge Pipin 6 Check the Mechanical Unit Cables and Connectors 2 FIGURE OF DRIVE MECHANISM **51 NOTE FOR PART REPLACEMENT** 55 REPLACING THE J1-AXIS MOTOR (M1) AND REDUCER 57 REPLACING THE J2-AXIS MOTOR (M2) AND REDUCER 78 REPLACING THE J3-AXIS MOTOR (M3), GEARBOX, AND REDUCER REPLACING THE WRIST AXIS MOTORS (M4, M5, AND M6), WRIST UNIT, AND J4 AXIS REDUCER. 121 SEALANT APPLICATION 131 REPLACING MOTOR COVERS (OPTION) 140 CABLE FORMING 147 CABLE REPLACEMENT 166 c-1 TABLE OF CONTENTS 5.3.1 5.3.2 5.3.3 5.3.4 5.3.5 5.4 6 Replacement Procedure (R-2000iB/165F/210F/185L/250F/125L /175L/100H/150U/220U) .. 176 Replacement Procedure (R-2000iB/170CF) Replacement Procedure (R-2000iB/165R/200R/100P) . 185 Replacement Procedure (R-2000iB/210WE) . 192 Replacement Procedure (R-2000iB/165CF) 200 LIMIT SWITCH 211 6.1 6.2 6.3 6.4 7 B-82235EN/08 OVERVIEW **REPLACEMENT (OPTION)** 207 MASTERING 211 RESETTING ALARMS AND PREPARING FOR MASTERING 212 FIXTURE POSITION MASTER 213 VERIFYING MASTERING 228 SEVERE DUST/LIQUID PROTECTION PACKAGE . 229 7.1.1 7.1.2 7.1.3 7.2 Severe Dust/Liquid Protection Characteristics . 229 Configuration of the Severe Dust/Liquid Protection Package.... . 231 REPLACING SEVERE DUST/LIQUID PROTECTION PACKAGE COMPONENTS 230 Notes on Specifying Severe Dust/Liquid Protection Package...... . 231 7.2.1 .. 237 B MECHANICAL UNIT CIRCUIT DIAGRAM 7.2.2 Replacing Motor Covers . .. 231 Replacing Cable Protection Sheaths 231 APPENDIX A MAINTENANCE PARTS 246 C PERIODIC MAINTENANCE TABLE . . 262 D STRENGTH OF BOLT AND BOLT TORQUE LIST 276 c-2 1.CHECKS AND MAINTENANCE B-82235EN/08 1 CHECKS AND MAINTENANCE Optimum performance of the robot can be maintained by performing the checks and maintenance procedures presented in this chapter. (See the APPENDIX C PERIODIC MAINTENANCE TABLE.) NOTE The periodic maintenance procedures described in this chapter assume that the FANUC robot is used for up to 3840 hours a year. In cases where robot use exceeds 3840 hours/year, adjust the given maintenance frequencies accordingly. The ratio of actual operating time/year vs. the 3840 hours/year should be used to calculate the new (higher) frequencies. For example, when using the robot 7680 hours a year, the maintenance frequency should be divided by 2. 1.1 PERIODIC MAINTENANCE 1.1.1 Daily Checks Clean each part, and visually check component parts for damage before daily system operation. Check the following items when necessary. Check items Oil seepage Air control set Vibration, Abnormal noises Positioning accuracy Peripheral equipment for proper operation Brakes for each axis Warnings Check points and management Check to see if there is oil on the sealed part of each joint. If there is an oil seepage, clean it. ="1.2.1 Confirmation of oil seepage" (When air control set is used) ="1.2.2 Confirmation of the Air Control Set or Air Purge Kit" Check whether vibration or abnormal noises occur. When vibration or abnormal noises occur. When vibration or abnormal noises occur. whether the taught positions of the robot have not deviated from the previous taught positions. When the displacement occurs, perform the measures as described in the following section: ="3.1 TROUBLESHOOTING" (Symptom : Displacement) Check whether the peripheral equipment operate properly according to commands from the robot and the peripheral equipment. Check that the end effector drops within 0.2 mm when serve power is turned off. If the end effector (hand) drops, perform the measures as described in the following section: ="3.1 TROUBLESHOOTING "(symptom : Dropping axis) Check whether unexpected warnings occur in the alarm screen on the teach pendant. If unexpected warnings occur, perform the measures as described in the following manual: ="R-30iB/R-30iB Mate CONTROLLER OPERATOR'S MANUAL (Alarm Code List)(B-83284EN-1) or R-30iA/R-30iB/R-Checks and Maintenance Check the following items at the intervals recommended below based on the total operating time, whichever comes first. (O : Item needs to be performed.) Check and maintenance intervals (Operating time, whichever comes first. 960h O O 1 years 3840h 1.5 years 5760h 2 years 7680h 3 years 11520h 4 years 15360h Cleaning the controller ventilation system only 1st Check points, management and maintenance table No. 24 check O O O O O O NI 1st check Check whether the robot has external damage or peeling paint due to the interference with the peripheral equipment. If an interference occurs, eliminate the cause a problem in which the robot will not operate, replace the damaged parts. Check whether the cause a problem is serious, and causes a problem in which the robot will not operate, replace the damaged parts. of the mechanical unit cable of the cable protection sheath is damaged due to the interference with peripheral equipment, eliminate the cause. ="1.2.3 Check the mechanical unit cable and connectors" Check whether wear debris is Check wear debris of the balancer and J1-axis swing generated on the following parts. • Balancer rod, support part of in stopper rotation part If serious wear occurs on the part that generated the wear debris, replace the part. Check for water Check whether the robot is subjected to water or cutting oils. If water is found, remove the cause and wipe off the liquid. Check whether the cable connected Check for damaged to the teach pendant, operation box damaged. If damage is found, connection cable replace the damaged cables. or the robot connection cable Check the external damage or peeling paint O -2-1234251. CHECKS AND MAINTENANCE B-82235EN/08 Check and maintenance intervals (Operating time) item 1 month 320h 3 months 960h 1 year 3840h O O Only 1st 1.5 years 5760h 2 years 7680h 3 years 11520h 4 years 15360h Check for damage to the mechanical unit cable (movable part) check $\cap \cap$ Only 1st Check for damage to the end effector (hand) connection cable Check $\cap \cap$ Only 1st Check the connectors check $\cap \cap$ Only 1st Check for damage to the end effector (hand) connection cable Check $\cap \cap$ Only 1st Check the connectors check $\cap \cap$ Only 1st Check the connection of each axis motor and other exposed connectors check $\cap \cap$ Only 1st Check the connection of each axis motor and other exposed connectors check $\cap \cap$ Only 1st Check the connection cable Check $\cap \cap$ Only 1st Check the connectors check $\cap \cap$ Only 1st Check the connection cable Check $\cap \cap$ Only 1st Check the connectors check $\cap \cap \cap$ Only 1st Check the connectors check $\cap \cap \cap$ Only 1st Check the connectors check $\cap \cap \cap$ Only 1st Check the connectors check $\cap \cap \cap$ Only 1st Check the connectors check $\cap \cap \cap$ Only 1st Check the connectors check $\cap \cap \cap$ Only 1st Check the connectors check $\cap \cap \cap$ Only 1st Check the connectors check $\cap \cap \cap \cap$ Only 1st Check $\cap \cap \cap \cap \cap$ Only 1st Check $\cap \cap \cap \cap \cap$ Only 1st Check $\cap \cap \cap \cap$ Only 1st Check $\cap \cap \cap \cap \cap$ Only 1st Check $\cap \cap \cap \cap \cap$ Only 1st Check $\cap \cap \cap \cap \cap \cap$ Only 1st Check $\cap \cap \cap \cap \cap \cap \cap$ Only 1st Check $\cap \cap \cap \cap \cap \cap \cap$ Only 1st Check $\cap \cap \cap \cap \cap \cap \cap \cap$ Only 1st Check $\cap \cap \cap \cap \cap \cap \cap \cap$ Only 1st Check $\cap \cap \cap \cap \cap \cap \cap \cap \cap \cap$ Only 1st Check $\cap \cap \cap$ Only 1st Only 1st O Check points, management and maintenance method Check the mechanical stopper and the adjustable mechanical stopper check -3- Observe the movable part of the mechanical unit cable, and check for damage. Also, check whether the cables are excessively bent or unevenly twisted. ="1.2.3 Check the mechanical unit cable and connectors" Check whether the end effector connection cables are unevenly twisted or damaged. If damage is found, replace the damaged cables. Check the mechanical unit cable and connectors" Retighten the end effector mounting bolts. Refer to the following section for tightening torque information: ="4.1 END EFFECTOR INSTALLATION TO WRIST of OPERATOR'S MANUAL (B-82234EN)" Retighten the robot installation bolts, bolts to be removed for inspection, and bolts exposed to the outside. Refer to the recommended bolt tightening torque guidelines at the end of the manual. An adhesive to prevent bolts from loosening is applied to some bolts. If the bolts are tightened with greater than the recommended torque, the adhesive might be removed. Therefore, follow the recommended bolt tightening torque guidelines when retightening torque guidelines w and check the looseness of the stopper mounting bolts. Check that the J1-axis swing stopper rotates smoothly. ="1.2.4 Check of Fixed Mechanical Stopper" Periodic maintenance table No. 5 6 7 8 9 10 1. CHECKS AND MAINTENANCE B-82235EN/08 Check and maintenance intervals (Operating time, Check and maintenance Accumulated operating time) item 1 month 320h 3 months 960h 1 years 5760h 2 years 7680h 3 years 15360h Clean spatters, sawdust and dust Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the operation of the cooling fan Only 1st check \bigcirc \bigcirc Check the opera and maintenance method Replacing the mechanical unit batteries Replacing the grease of each axis reducer Check the purge piping (210WE) 1st check that spatters, sawdust, or dust does not exist on the robot main body. If dust has accumulated, remove it. Especially, clean the robot movable parts well (each joint, the balancer rod. the support part of in front and behind of the balancer, and the cable protection sheaths). (When cooling fans are installed on the each axis motor) Check whether the cooling fans are operating correctly. If the cooling fans do not operate, replace them. Supply grease to the balancer bush. ="2.1 Greasing the Balancer Bush" Replace the mechanical unit batteries ="2.2 Replacing the batteries" Replace the grease of each axis reducer (*) Periodic interval differs according to the model. Except 210WE: 3 years (11520 hours) ="2.3 Replacing the Balancer Bush" Replace the grease of each axis reducer (*) Periodic interval differs according to the model. no breakage on purge piping. ="1.2.5 Confirm there is no breakage on purge piping" Replace the mechanical unit cable. Refer to Chapter 7 Replacing batteries of R-30iB CONTROLLER MAINTENANCE MANUAL (B-83195EN) or R-30iA CONTROLLER MAINTENANCE MANUAL (B-82595EN)" Periodic maintenance table No. 11 12 13 14 15 to 21 22 23 26 1. CHECKS AND MAINTENANCE B-82235EN/08 1.2 CHECK POINTS 1.2.1 Confirmation of Oil Seepage Check items Check to see whether there is an oil seepage on the rotating parts of each joint axis. Fig. 1.2.1 Check points of oil seepage Management Oil might accumulate on the outside of the seal lip depending on the movement condition or environment of the axis. If the oil changes to a state of liquid, the oil might fall depending on the axis movement. To prevent oil spots, be sure to wipe away any accumulated oil under the axis components before you operate the robot. Also, drive mechanisms might become hot and the internal pressure of the grease bath might rise by frequent repetitive movement and use in high temperature environments. In these cases, normal internal pressure can be achieved by venting the grease outlet, refer to Subsection 2.3.3 and ensure that grease is not expelled onto the machine or tooling.) WARNING Grease may come out suddenly when opening the grease outlet. Attach bags for collecting grease. If you must wipe oil frequently, and opening the grease outlet does not stop the seepage perform the measures below. ="3.1 TROUBLESHOOTING "(symptom : Grease leakage) -5- 1.CHECKS AND MAINTENANCE 1.2.2 B-82235EN/08 Confirmation of the Air Control set or Air Purge Kit When an air control set or Air purge kit is used, check the items below. Item Check items 1 3 Air pressure 8 Dryer Drain Lubricator Oil inlet Handle for lubricator adjustment Lubricator oil drop amount check Lubricator Regulator pressure setting Filter Fig. 1.2.2 (a) Pressure gauge Air control set (option) 空気出力口 ((q0 010 エアチューブ) Air tube) S 0 7 In case of air purge kit Check the joints, tubes, etc. for leaks. Retighten the joints or replace parts, as required. Check the drain and release it. When quantity of the air supply side. Check the supply side. Check the supply side. Check the supply side. (0.2kgf/cm), adjust it using the regulator pressure setting handle. Check whether the color of the dew point checker is blue. When it is not blue, identify the cause and replace the dryer. Maintenance for air purge kit, refer to the operator's manual attached kit. Check drain, When quantity of the drain is remarkable, examine the setting of the air dryer. to the air supply side. S O 2 Check points Check air pressure using the pressure gauge on the air control set as shown in Fig. 1.2.2 (a). If it does not meet the specified pressure of 0.49 to 0.69 MPa (5-7 kgf/cm2), adjust it using the regulator pressure-setting handle. Check the number of oil drops during operation. If it does not meet the specified value (1 drop/10-20 sec), adjust it using the handle for lubricator adjustment. The lubricator becomes empty in about 10 to 20 days under normal operation. Check to see that the lubricator level is within the specified level. Handle for 圧力調整用ノブ Lubricator adjustment Fig. 1.2.2 (b) Regulator kit for air purge kit (option) -6- 1.CHECKS AND MAINTENANCE B-82235EN/08 1.2.3 Check the Mechanical Unit Cables and Connectors Check points of the mechanical unit cables Fixed part cables from above the J1, J2, and J3 movable parts and peripheral equipment *For the J1-axis, inspect the cables from above the J2 base and from the side by removing the metal plate on the side of the MAINTENANCE B-82235EN/08 < Cables > Check that there is no wear or damage on the cable jacket. If the inside wire rods are exposed due to wear or damage, replace the cables. Open the Check that there is no wear or damage on the cable jacket. If the inside wire rods are exposed due to wear or damage as shown in here, replace the cables. Open the Check the sheath jacket If the jacket If the jacket If the jacket as a shown in here, replace the cables. Power/brake connectors of the motor exposed externally Robot connector for tightness. Fig. 1.2.3 (d) Connector Inspection points -8- 1.CHECKS AND MAINTENANCE B-82235EN/08 1.2.4 Check that there is no evidence of a collision on the mechanical stopper, replace the parts. Check the tightness of the stopper mounting bolts. If they are loose, retighten them. Be sure to check the tightness of the mounting bolts of the I1-axis swing stopper. Check that I1-axis swing stopper rotates smoothly. Refer to Section 6.2 of the operator's manual for details regarding the adjustable mechanical stopper. Check the tightness of bolts ボルトの緩みがないこと Confirm the smooth rotation ストッパが滑らかに回転することを of確認する the swing stopper Plus side stopper プラス側ストッパ Minus side stopper マイナス側ストッパ Check the tightness of bolts ボルトに緩みがないことを確認する PL US MINUS Check of Fixed Mechanical Stopper J3-axis adjustable mechanical stopper J3-axis adjustable mechanical stopper マイナス側ストッパ (オプション) (option) Minus side stopper マイナス側ストッ パ Plus side stopper プラス側ストッパ J1-axis mechanical stopper J1軸機械式ストッパ J1-axis adjustable mechanical stopper (option) J2軸機械式可変ストッパ Fig. 1.2.4 Check of fixed mechanical stopper and adjustable mechanical stopper -9- 1. CHECKS AND MAINTENANCE 1.2.5 B-82235EN/08 Confirm There is No Breakage on Purge Piping (Only R-2000iB/210WE) Check that there is no evidence of a collision on the mechanical stopper and the adjustable Connection part of piping Purge air piping Rc1/2 Female (Purge air inlet side) Fig. 1.2.5 (a) Confirming the purge piping (R-2000iB/210WE)(A05B-1329-B255) Connection part of piping Rc1/2 Female (Purge air piping Rc1/2 Female (Purge air inlet side) Fig. 1.2.5 (b) Confirming the purge air piping Rc1/2 Female (Purge air inlet side) - 10 - 1. CHECKS AND MAINTENANCE B-82235EN/08 1.3 MAINTENANCE TOOLS The following tools and instruments are required for the maintenance procedures contained in this manual. (a) Measuring instruments Instruments Instruments Instruments (+) screwdriver: Nut driver: Nut driver: Hexagon wrench set: Applications Measurement of positioning and backlash Measurement of backlash Large, medium, small Large, medium, small 2, 5, 6, 8, 10, 12, 14, 17 (For replacing part) Medium and small sizes Adjustable wrench: Pliers Cutting nippers Double hexagon offset wrench Pliers for C-retaining ring

balancer connection) Spanner : 30 x 32mm or 32 x 36mm (Thickness: 14mm or less for stopping J41 gear rotation) T-shaped hexagonal wrench: M8 (Length: 250mm or more. Used for J3-axis motor connection) Flashlight (c) Special Tools Common to R 2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L/150U/220U A290-7327-Z921 Press-fit fixture for oil seal of upper side of J1-axis reducer (in J2 base) See Fig. 1.3 (a). A290-7324-X922 (Spring pin striking tool for J1-axis reducer (in J2 base) See Fig. 1.3 (a). replacement) See Fig. 1.3 (c). A290-7324-X923 2pcs (Bearing press-fit fixture to J1-axis motor) See Fig. 1.3 (d). A290-7329-X921 (Guide pin (M16) for J1-axis reducer) (For right side of R-2000iB/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U) 11 - 1.CHECKS AND MAINTENANCE B-82235EN/08 (For R-2000iB/170CF) See Fig. 1.3 (f). A290-7329-X923 (Robot hanging jig for replacing J1-axis reducer) (R-2000iB/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U) See Fig. 1.3 (g). A290-7329-Y922 2pcs (Robot hanging jig for replacing J1-axis reducer) (R-2000iB/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U) See Fig. 1.3 (g). A290-7329-Y922 2pcs (Robot hanging jig for replacing J1-axis reducer) (R-2000iB/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U) See Fig. 1.3 (g). A290-7329-Y922 2pcs (Robot hanging jig for replacing J1-axis reducer) (R-2000iB/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U) See Fig. 1.3 (g). A290-7329-Y922 2pcs (Robot hanging jig for replacing J1-axis reducer) (R-2000iB/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U) See Fig. 1.3 (g). A290-7329-Y922 2pcs (Robot hanging jig for replacing J1-axis reducer) (R-2000iB/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U) See Fig. 1.3 (g). A290-7329-Y922 2pcs (Robot hanging jig for replacing J1-axis reducer) (R-2000iB/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U) See Fig. 1.3 (g). A290-7329-Y922 2pcs (Robot hanging jig for replacing J1-axis reducer) (R-2000iB/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U) See Fig. 1.3 (g). A290-7329-Y922 2pcs (Robot hanging jig for replacing J1-axis reducer) (R-2000iB/165F/210F/185L/250F/210WE/125U/175L/100H/150U/220U) See Fig. 1.3 (g). A290-7329-Y922 2pcs (Robot hanging jig for replacing J1-axis reducer) (R-2000iB/165F/210F/185L/250F/210WE/125U/175L/100H/150U/220U) See Fig. 1.3 (g). A290-7329-Y922 2pcs (Robot hanging jig for replacing J1-axis reducer) (R-2000iB/165F/210F/185L/250F/210WE/125U/175L/100H/150U/220U) See Fig. 1.3 (g). A290-7329-Y922 2pcs (Robot hanging jig for replacing J1-axis reducer) (R-2000iB/165F/210WE/125U/175L/100H/150U/220U) See Fig. 1.3 (g). A290-7329-Y922 2pcs (Robot hanging J1-axis reducer) (R-2000iB/165F/210WE/125U/175L/100H/150U/220U) See Fig. 1.3 (g). A290-7329-Y922 2pcs (Robot hanging J1-axis reducer) (R-2000iB/165F/ 200R, 100P) See Fig. 1.3 (h). A290-7329-Z922 2pcs (Robot hanging jig for replacing J1-axis reducer) (For R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fixation fixture for maintenance) (Except R-2000iB/165CF) See Fig. 1.3 (i). A05B-1329-K943 (J3 arm fix 1329-K944 (J2 arm fixation fixture for maintenance) (R-2000iB/165CF) See Fig. 4.4 (e) A05B-1329-K945 (J3 arm fixation fixture for maintenance) (R-2000iB/165CF) See Fig. 4.5 (e) R A 0 .5 (, X MA) 3 30° X MA (O 48.6) O 60 0.5 O 120 O 40 0 -0.2 O 130 O 159 R A 16 9 200 234 SECTION A-A A290-7327-Z921 M12 O 12 O 12.5 Fig. 1.3 (a) Oil seal which is above J1-axis reducer (in J2 base) installation fixture O6 C1 20 30 10 250 A290-7324-X921 Fig. 1.3 (b) Guide pin (M12) for J1-, J2-, J3-axis reducer replacement - 12 - 30 1.CHECKS AND MAINTENANCE B-82235EN/08 105 45 O 6.5 ±0.1 ローレット並目 KNURLING 170 A290-7324-X922 Fig. 1.3 (c) Spring pin striking tool for J1-axis reducer replacement O 16 M16 C1 O8 25 30 150 A290-7324-X923 Fig. 1.3 (d) Guide pin (M16) for J1-, J2-, J3-axis reducer replacement 5 A O 60 O 41 90 O 50 O 10 O 25 C1 (20) R 0.8 A 5 SECTION A-A SECTION 断面 A290-7329-X921 Fig. 1.3 (e) Bearing press-fit fixture to J1-axis motor - 13 - 1.CHECKS AND MAINTENANCE B-82235EN/08 2-M2(219.5) 25 25 228 25 25 152.5 32 32 16 16 16 16 010 THRU 700 A290-7329-X923 質量 WEIGHT 5.2kg Fig. 1.3 (g) Hanging jig for replacing J1-axis reducer (For left side of R-2000iB/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U) - 14 - 1.CHECKS AND MAINTENANCE B-82235EN/08 1800 1700 30 50 2-O24 THRU 30 45 50 125 13 10-D24 THRU 30 45 50 125 THRU 30 45 THRU 30 O14 THRU 75 132.5 2525 235 25 25 1405 THRU 220 貫通 質量 WEIGHT 34 kg A290-7329-Y922 Fig. 1.3 (h) Hanging jig for replacing J1-axis reducer (For R-2000iB/165R/200R/100P) 4-O14 THRU 3- C5 R 145.5 110 O40 THRU R 15 ° 30 R1 55.5 20 15 ° 145 150 C 2- 70 6° 0° 35 32 ° 35 22 280 THRU 質量 WEIGHT 貫通 A290-7329-Z922 Fig. 1.3 (i) Hanging jig for replacing J1-axis reducer (For R-2000iB/170CF) - 15 - 2.3 kg 2.PERIODIC MAINTENANCE 2 B-82235EN/08 PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE 2.1 GREASING environment of the robot is bad, however, greasing points of the balancer bush. Recommended grease Table 2.1 (a) Greasing the Balancer Bush Amount of grease Showa Shell Sekiyu K. K. Alvania grease S2 Specification: A97L-0001-0179#2 10 ml for each (two points) Greasing interval Shorter among 1 year or every 3840 hours of accumulated operation Table 2.1 (b) Grease Alternative to Alvania Grease S2 Mobile JX Nippon Oil & Energy Corporation JX Nip Eponex grease No. 2 Dynamax No. 2 Shell Gadus S2 V100 2 Table 2.1 (c) Spec. of the grease nipple Parts name Specification Grease nipple A97L-0218-0013#A610 Greasing points (R-2000iB/165F/210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H) NOTE For the R-2000iB/170CF/150U/220U/165CF, no balancer is provided. - 16 - 2.PERIODIC MAINTENANCE B-82235EN/08 2.2 REPLACING THE BATTERIES (1.5-YEAR (5760 HOURS) PERIODIC MAINTENANCE) The position data of each axis is preserved by the backup batteries. The batteries need to be replaced every 1.5 year (or time a total operating time of 5760 hours is reached.). Also use the following procedure to replace when the battery, make sure to press the EMERGENCY STOP button to stop robot motion. CAUTION Be sure to keep controller power turned on. Replacing the batteries with the power turned off causes all current position data to be lost. Therefore, mastering will be required again. 2 3 4 5 Remove the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (AUTION the battery case cap. CAUTION the battery case cap. (Automatic case) and the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the battery case cap. (Fig. 2.2 (a), (b)) Take out the old batteries from the When using a robot with the severe dust/liquid protection option, remove the cover from the battery case as shown in Fig. 2.2 (c) to replace gasket with new one for severe dust/liquid protection. CAUTION In case of 210WE, remove J1 base side cover and replace the battery referring to Fig. 2.2 (d). After replacing the battery, reinstall the cover. In this time, replace gasket with a new one for sealing up characteristics of battery store space. Battery spec: A98L-0031-0005 (1.5V, D battery (alkali) 4 pcs) Case cap Fig. 2.2 (a) Replacing the battery (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/125L/175L/100H/150U/220U) - 17 - 2.PERIODIC MAINTENANCE Battery (R-2000iB/165CF) Gasket A290-7125-X820 (This is attached to plate) Plate Bolt M4X10SUS (6 pcs) Fig. 2.2 (c) Removing the battery cover plate (When severe dust/liquid protection is specified.) (R-2000iB/165F/210F/185L/250F/165R/200R/170CF/125L/175L/150U) - 18 - 2.PERIODIC MAINTENANCE B-82235EN/08 Bolt A6-BA-4X10SUS (8 pcs) Plate Gasket A290-7329-Z224 Battery case Battery spec. :A98L-0031-0005 (1.5V D battery 4 pcs) Fig. 2.2 (d) Case cap Replacing the battery (R-2000iB/210WE) - 19 - 2.PERIODIC MAINTENANCE 2.3 B-82235EN/08 REPLACING THE GREASE OF THE DRIVE MECHANISM (3-YEAR (11520 HOURS) PERIODIC MAINTENANCE) According to below, replace the grease of the reducers of J1, J2, and J3 axes, the J4-axis gearbox, and the wrist at the intervals based on every 3 years or 11520 hours (every 1 year or 3840 hours for 210WE), whichever comes first. See Table 2.3 (a),(b) for the grease name and the quantity. Models R-2000iB/165F R-2000 R-2000iB/170CF R-2000iB/100H R-2000iB/165CF Table 2.3 (a) Grease for 3-years (11520 hours) periodical replacement Grease supplying Quantity Gun tip pressure position J1-axis reducer J2-axis reducer J3-axis reducer J4-axis gearbox wrist 1 wrist 2 J1-axis reducer J2-axis reducer J3-axis reducer J3-axi 2200g(2500ml) 1700g(1900ml) 2100g(2400ml) 2100g(2500ml) 3100g(3500ml) 3100g(3500ml) 3100g(3500ml) 3100g(3500ml) 3100g(2500ml) 3100g(2500ml(800ml) 4900g(5500ml) 3100g(3500ml) 2200g(2500ml) 1700g(1900ml) 1400g(1600ml) 700g (800ml) 3600g(4100ml) 2300g(2600ml) 1400g(3950ml) 350g (400ml) 0.15 MPa or less (NOTE) Grease name Kyodo yushi VIGOGREASE RE0 Spec : A98L-0040-0174 3400g(3950ml) 350g (400ml) 0.15 MPa or less (NOTE) Grease name Kyodo yushi VIGOGREASE RE0 Spec : A98L-0040-0174 3400g(3950ml) 350g (400ml) 0.15 MPa or less (NOTE) Grease name Kyodo yushi VIGOGREASE RE0 Spec : A98L-0040-0174 3400g(3950ml) 350g (400ml) 0.15 MPa or less (NOTE) Grease name Kyodo yushi VIGOGREASE RE0 Spec : A98L-0040-0174 3400g(3950ml) 350g (400ml) 0.15 MPa or less (NOTE) Grease name Kyodo yushi VIGOGREASE RE0 Spec : A98L-0040-0174 3400g(3950ml) 350g (400ml) 0.15 MPa or less (NOTE) Grease name Kyodo yushi VIGOGREASE RE0 Spec : A98L-0040-0174 3400g(3950ml) 350g (400ml) 0.15 MPa or less (NOTE) Grease name Kyodo yushi VIGOGREASE RE0 Spec : A98L-0040-0174 3400g(3950ml) 350g (400ml) 0.15 MPa or less (NOTE) Grease name Kyodo yushi VIGOGREASE RE0 Spec : A98L-0040-0174 3400g(3950ml) 350g (400ml) 0.15 MPa or less (NOTE) Grease name Kyodo yushi VIGOGREASE RE0 Spec : A98L-0040-0174 3400g(3950ml) 350g (400ml) 0.15 MPa or less (NOTE) Grease name Kyodo yushi VIGOGREASE RE0 Spec : A98L-0040-0174 3400g(3950ml) 350g (400ml) 0.15 MPa or less (NOTE) Grease name Kyodo yushi VIGOGREASE RE0 Spec : A98L-0040-0174 3400g(3950ml) 350g (400ml) 0.15 MPa or less (NOTE) Grease name Kyodo yushi VIGOGREASE RE0 Spec : A98L-0040-0174 3400g(3950ml) 350g (400ml) 0.15 MPa or less (NOTE) Grease name Kyodo yushi VIGOGREASE RE0 Spec : A98L-0040-0174 3400g (3950ml) 350g (400ml) 0.15 MPa or less (NOTE) Grease name Kyodo yushi VIGOGREASE RE0 Spec : A98L-0040-0174 3400g (3950ml) 350g (400ml) 0.15 MPa or less (NOTE) Grease name Kyodo yushi VIGOGREASE RE0 Spec : A98L-0040-0174 3400g (3950ml) 350g (400ml) 0.15 MPa or less (NOTE) Grease name Kyodo yushi VIGOGREASE RE0 Spec : A98L-0040-0174 3400g (3950ml) 350g (400ml) pumping cycles per three seconds. - 20 - 2.PERIODIC MAINTENANCE B-82235EN/08 Table 2.3 (b) Grease for 1-year (3840 hours) periodical replacement Grease supplying Quantity Gun tip pressure position Models J1-axis reducer J2-axis 2350g(2640ml) 1700g(1900ml) 3400g(3800ml) 1000g(1100ml) Grease name Kyodo yushi VIGOGREASE RE0 Spec : A98L-0040-0174 0.15MPa or less (NOTE) NOTE When a manual pump is used for greasing, the standard rate is two pumping cycles per three seconds. For grease replacement or replenishment, use the posture s indicated below. Table 2.3 (c) Postures for greasing (R-2000iB/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U/165CF) Grease supplying position J1-axis reducer J2-axis reducer J2 greasing (R-2000iB/165R/200R/100P) Grease supplying position J1-axis reducer J2-axis reducer J2-axis reducer J4-axis gearbox Wrist Posture J1 J2 Arbitrary Arbitrary Arbitrary 4 J5 J6 Arbitrary Arbitrary 4 J5 J6 Arbitrary Arbitrary 4 J5 J6 Arbitrary Arbitrary Arbitrary 0° 0° 0° J4 J5 J6 Arbitrary (M6X8) Taper plug (R1/4) Taper plug (R1/4) Taper plug (R1/8) Grease nipple A97L-0218-0417#121515 A97L-0218-0417#060606 greasing posture described in Table 2.3 (c), (d) and (e). Turn off the controller power. Remove the seal bolt from grease outlet. (Fig. 2.3 (a) to (e)) Supply new grease inlet until new grease is output from grease outlet. (Fig. 2.3 (a) to (e)) Supply new grease is output from grease outlet. axis reducer inlet Grease nipple Left side Right side J1-axis reducer inlet Grease nipple J1-axis reducer outlet M12x15 (Seal bolt) Fig. 2.3 (a) Replacing grease of the J1/J2-axis reducer inlet Grease nipple J2-axis reducer outlet Seal bolt J2axis reducer inlet Grease nipple J1-axis reducer outlet Grease nipple (Rear of connector panel) Fig. 2.3 (b) Replacing grease of the J1/J2-axis reducer outlet Seal bolt Left side J3-axis reducer inlet Grease nipple Right side Fig. 2.3 (c) Replacing grease of the J3-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H/150U/220U) J3-axis reducer and J3-axis gearbox grease inlet Grease nipple Fig. 2.3 (d) Replacing grease of the J3-axis reducer (R-2000iB/170CF) J3-axis reducer and J3-axis gearbox grease inlet Grease nipple Fig. 2.3 (d) Replacing grease of the J3-axis reducer and J3-axis reducer and J3-axis reducer and J3-axis reducer and J3-axis gearbox grease inlet Grease nipple Fig. 2.3 (d) Replacing grease of the J3-axis reducer and J3-axis gearbox grease and J3-axis reducer and J3-axis gearbox grease and J3-axis reducer and J3-axis gearbox grease 機排脂口 M68 M6X8 (Seal (シールボルト) bolt) J3-axis J3軸減速機給脂口 reducer inlet Greaseグリスニップル nipple Fig. 2.3 (e) Replacing grease of the J3-axis reducer (R-2000iB/165CF) - 23 - 2.PERIODIC MAINTENANCE B-82235EN/08 Grease Replacement Procedure for the J4-axis gearbox (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L /100H/150U/220U) 1 2 3 4 5 Move the robot to the grease is output from the grease outlet and the air inlet. (Fig. 2.3 (f)) Supply new grease until new grease is output from the grease outlet. Release remaining pressure using the procedure given in Section 2.4. J4-axis gearbox air inlet M1215 (seal bolt) J4-axis gearbox outlet M1215 (seal bolt) J4-axis gearbox outlet M1215 (seal bolt) J4-axis gearbox air inlet M1215 (seal b 2.PERIODIC MAINTENANCE B-82235EN/08 Grease Replacement Procedure for the J4-axis gearbox (R-2000iB/165CF) 1 2 3 4 5 Move the robot to the grease outlet. (Fig. 2.3 (g)) Supply new grease until new grease is output from the grease outlet. Release remaining pressure using the procedure given in Section 2.4. J4-axis gearbox, Wrist outlet 1 J4軸ギアボックス・手首
指脂口1 M68 (seal bolt) M6X8 (シールボルト) J4-axis gearbox, Wrist inlet 1 J4軸ギアボックス・手首
給脂口1 Grease nipple グリスニップル Fig. 2.3 (g) Replacing grease of the J4-axis gearbox (R-2000iB/165CF) Grease Replacement Procedure for the Wrist (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L /100H/150U/220U) 1 2 3 4 5 6 7 8 Move the robot to the greasing posture described in Table 2.3 (c) (d) and (e). Turn off the controller power. Remove the taper plug of wrist grease outlet 1 (Figs. 2.3 (h) and (i)). Supply grease to the wrist grease inlet until new grease outputs from wrist grease outlet 1. Attach the taper plug to wrist grease outlet 1. Next, remove the taper plug to wrist grease outlet 1. Next, remove the taper plug (or the seal bolt for the 210F/185L/250F/200R/100P/210WE/175L/ 220U) of wrist grease outlet 2. Supply new grease through the wrist grease inlet until new grease is output from wrist grease outlet 1. Next, remove the taper plug to wrist grease outlet 1. Next, remove the taper plug to wrist grease outlet 2. Supply new grease through the wrist grease inlet until new grease is output from wrist grease outlet 2. Supply new grease through the wrist grease inlet until new grease is output from wrist grease outlet 2. Supply new grease through the wrist grease inlet until new grease is output from wrist grease outlet 2. Supply new grease through the wrist grease inlet until new grease is output from wrist grease outlet 2. Supply new grease through the wrist grease inlet until new grease is output from wrist grease outlet 2. Supply new grease through the wrist grease inlet until new grease is output from wrist grease outlet 2. Supply new grease inlet until new grease is output from wrist grease outlet 2. Supply new grease is output from wrist grease outlet 2. Supply new grease inlet until new grease is output from wrist grease outlet 2. Supply new grease is output from wrist grease outlet 2. Supply new grease is output from wrist grease outlet 2. Supply new grease is output from wrist grease outlet 3. Supply new grease is output from wrist grease outlet 3. Supply new grease output from wrist grease output Release remaining pressure using the procedure given in Section 2.4. Wrist grease outlet 2 M6×6 (seal bolt) Wrist grease outlet 2 R1/8 (taper plug) Wrist grease outlet 1 R1/4 (taper plug) Wrist grease inlet grease outlet 1 R1/4 (taper plug) Wrist grease outlet 2 R1/8 (taper plug) Wrist grease outlet 2 R1/8 (taper plug) Wrist grease outlet 2 R1/8 (taper plug) Wrist grease outlet 1 R1/4 (taper plug) Wrist grease inlet grease outlet 2 R1/8 (taper plug) Wrist grease outlet 1 R1/8 (taper plug) Wrist grease outlet 1 R1/4 (taper plug) Wrist grease inlet grease outlet 2 R1/8 (taper plug) Wrist grease outlet 2 R1/8 (taper plug) Wrist grease outlet 1 R1/4 (taper plug) Wrist grease inlet grease inlet grease outlet 2 R1/8 (taper plug) Wrist grease outlet 2 R1/8 (taper Replacing grease of the wrist (R-2000iB/165F/165R/170CF/125L/100H/150U) - 25 - Fig. 2.3 (i) Replacing grease of the wrist (R-2000iB/210F/185L/250F/200R /100P/210WE/175L/220U) 2.PERIODIC MAINTENANCE B-82235EN/08 Grease Replacement Procedure for the Wrist (R-2000iB/165CF) 1 2 3 4 5 Move the robot to the greasing posture described in Table 2.3 (c). Turn off the controller power. Remove the taper plug of wrist grease outlet 1. Supply grease to the wrist grease outlet 1. When reusing the seal bolt, be sure to seal it with seal tape. Remove the seal bolt from wrist grease outlet 2. Supply new grease through wrist grease inlet 2 until the new grease is forced out of wrist grease outlet 2. Release remaining pressure using the procedure given in Section 2.4. 6 7 8 Wrist grease outlet 2 M6X8(Seal bolt) Fig. 2.3 (j) Replacing Grease of the Wrist (R-2000iB/165CF) 1 2 3 4 5 6 CAUTION Failure to follow proper greasing procedures may cause the suddenly increase of the grease leakage and abnormal operation. When greasing, observe the following cautions. Before starting to grease, open the grease outlet (remove the plug or bolt from the grease outlet). Supply grease slowly, using a manual pump. Whenever possible, avoid using an air pump is unavoidable, supply grease with the pump at a pressure lower than or equal to the gun tip pressure (see Table 2.3 (a),(b)). Use specified grease. Use of non-approved grease may damage the reducer or lead to other problems. After greasing, release remaining pressure from the grease outlet. To prevent the accident like fall, fire, remove all the excess grease from the floor and robot. - 26 -2.PERIODIC MAINTENANCE B-82235EN/08 2.4 PROCEDURE FOR RELEASING REMAINING PRESSURE FROM THE GREASE BATH Release remaining pressure as described below. Under the grease inlets and outlets, attach bags for collecting grease so that grease to the inlets or outlets. Open point 80 or more 90 or more 50% 50% 20 minutes A A 70 or more 50% 20 minutes A 100% 20 minutes B 100% 10 minutes C Grease replacement position J1-axis reducer J3-axis gearbox J4-axis gearbox J4-axis gearbox Wrist Motion angle J4: 60 or more J5:120 or more J4: 60 or more J5:120 or more J5:120 or more J4: 60 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more J4: 60 or more J4: 60 or more J5:120 or more J5:120 or more J5:120 or more J4: 60 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more J4: 60 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more J5:120 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more J5:120 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more J5:120 or more J6: 60 or more J5:120 or more 60 or more In the case of A Open the grease outlets and perform continuous operation. In the case of C Open all of the grease outlets shown below and perform continuous operation. In the case of C Open all of the grease outlets and outlets and outlets and outlets and outlets and perform continuous operation. In the case of C Open all of the grease one here Wrist grease inlet grease nipple Wrist grease outlet 1 R1/8 (taper plug) Right side Fig.2.4 (a) Open Points for Releasing Remaining Pressure from the Wrist grease outlet 2 M6×6 (seal bolt) Also open here. Left side Wrist grease outlet 1 R1/8 (taper plug) Right side Fig.2.4 (a) Open Points for Releasing Remaining Pressure from the Wrist grease outlet 1 R1/8 (taper plug) Right side Fig.2.4 (a) Open Points for Releasing Remaining Pressure from the Wrist grease outlet 1 R1/8 (taper plug) Right side Fig.2.4 (a) Open Points for Releasing Remaining Pressure from the Wrist grease outlet 1 R1/8 (taper plug) Right side Fig.2.4 (a) Open Points for Releasing Remaining Pressure from the Wrist grease outlet 1 R1/8 (taper plug) Right side Fig.2.4 (a) Open Points for Releasing Remaining Pressure from the Wrist grease outlet 1 R1/8 (taper plug) Right side Fig.2.4 (a) Open Points for Releasing Remaining Pressure from the Wrist grease outlet 1 R1/8 (taper plug) Right side Fig.2.4 (a) Open Points for Releasing Remaining Pressure from the Wrist grease outlet 1 R1/8 (taper plug) Right side Fig.2.4 (a) Open Points for Releasing Remaining Pressure from the Wrist grease outlet 1 R1/8 (taper plug) Right side Fig.2.4 (tap R1/4 (taper plug) Wrist grease inlet grease inlet grease inlet 2 手首給脂口2 grease inlet 2 手首給脂口2 grease inlet 2 手首排脂口2 M6X8 (seal bolt) Wrist grease inlet 2 手首給脂口2 grease inlet 2 手首給脂口2 grease inlet 2 手首給脂口2 m6X8 (seal bolt) Wrist grease outlet 1 手首排脂口1 M6X8 (seal bolt) M6X8 (シールボルト) M6X8 (シールボルト) Wrist grease inlet 1 手首給脂口1 grease nipple グリ-スニップル Fig. 2.4 (c) Open Points for Releasing Remaining Pressure from the Wrist (R-2000iB/165CF) If the above operation cannot be performed due to the environment, prolong the operating time so that an equivalent operation can be performed. (If only half of the predetermined motion angle can be set, perform an operation for a time twice as long as the same time. After completion of the operation, attach the seal bolts and grease nipples to the grease inlets and outlets. When reusing the seal bolts and grease nipples, be sure to seal them with seal tape. - 28 - 3.TROUBLESHOOTING B-82235EN/08 3 TROUBLESHOOTING B-82235EN/08 3 TROUBLESHOOTING The source of mechanical unit problems may be difficult to locate because of overlapping causes. Problems may be come further complicated, if they are not corrected properly. Therefore, you must keep an accurate record of problems and take proper corrective actions. 3.1 TROUBLESHOOTING Table 3.1 Symptom Vibration vibration a failure cause or which measures to take, contact your local FANUC representative. Table 3.1 Symptom Vibration Abnormal noise Description - - - - - TROUBLESHOOTING Cause [Base plate and floor plate fastening] As the robot operates, its It is likely that the base plate is not securely fastened to the floor fastened to the floor fastened. to the floor plate, it lifts plate as the robot operates, allowing the There is a crack in the weld base and floor plates to strike that fastening] The J1 base operates. plate. There is a gap between the Probable causes are a loose bolt, J1 base and floor plate. an insufficient degree of surface A J1 base plate and floor plate. If the robot is not securely fastened to the base plate, the J1 base plate as the robot operates, allowing the base and floor plates to strike each other which, in turn, leads to vibration. [Rack or floor] The rack or floor plate It is likely that the robot. If they are not rigid enough, counterforce deforms the rack or floor, and responsible for the vibration. - 29 - - - - - Measure Re-weld the base plate to the floor plate. If the weld is not strong enough, increase its width and length. If a bolt is loose, apply LOCTITE and tighten it to the appropriate torque. Adjust the base plate, remove it. Apply adhesive between the J1 base and base plate. Reinforce the rack or floor to make it more rigid. If reinforcing the rack or floor is impossible, modify the robot control program; doing so might reduce the vibration. 3.TROUBLESHOOTING Symptom Description Vibration Abnormal noise (Continued) - - - - Vibration becomes more serious when the robot adopts a specific posture. If the operating speed of the robot is reduced, vibration stops. Vibration is most noticeable when the robot control program is most noticeable when the robot is accelerating. Vibration occurs when the robot is accelerating. too demanding for the robot hardware. It is likely that the ACCELERATION value is excessive. Vibration or abnormal noise [Broken gear, bearing, or reducer] It is likely that collision or overload was first noticed after the applied an excessive force on the robot was the gear tooth surface or rolling overloaded for a long surface of a bearing, or reducer. period. It is likely that foreign material caught in a gear, bearing, or inside the reducer has caused damage on the gear tooth surface or rolling surface of the bearing, or reducer. It is likely that foreign material caught in a gear, bearing, or inside the reducer has caused vibration. It is likely that foreign material caught in a gear, bearing, or reducer. It is likely that foreign material caught in a gear, bearing, or inside the reducer has caused vibration. It is likely that foreign material caught in a gear, bearing, or inside the reducer has caused vibration. It is likely that foreign material caught in a gear, bearing, or reducer. It is likely that foreign material caught in a gear, bearing, or inside the reducer has caused vibration. It is likely that foreign material caught in a gear, bearing, or inside the reducer has caused vibration. It is likely that foreign material caught in a gear, bearing, or inside the reducer has caused vibration. It is likely that foreign material caught in a gear, bearing, or inside the reducer has caused vibration. It is likely that foreign material caught in a gear, bearing, or inside the reducer has caused vibration. It is likely that foreign material caught in a gear, bearing, or inside the reducer has caused vibration. It is likely that foreign material caught in a gear, bearing, or inside the reducer has caused vibration. It is likely that foreign material caught in a gear has caused vibration. It is likely that foreign material caught in a gear has caused vibration. It is likely that foreign material caught in a gear has caused vibration. It is likely that foreign material caught in a gear has caused vibration. It is likely that foreign material caught in a gear has caused vibration. It is likely that foreign material caught in a gear has caused vibration. It is likely that foreign material caught in a gear has caused vibration. It is likely that foreign material caught in a gear has caused vibration. It is likely that foreign material caught in a gear has caused vibration. It is likely that foreign material caught in a gear has caused a bearing, or reducer due to metal fatigue by neglect greasing. Above causes will generate cyclical vibration and abnormal noise. - 30 - Measure Check the maximum load that the robot control program. Vibration in a specific portion can be reduced by modifying the robot control program while slowing the robot and reducing its acceleration (to minimize the influence on the entire cycle time). Operate each axis at individually to judge which axis has been vibrating. Remove the motor, and replace the gear, the bearing, and the reducer. For the specification of parts and the procedure of replacement contact your local FANUC representative. Using the robot within its maximum rating prevents problems with the drive mechanism. Specific type and period of grease change will prevent troubles. 3.TROUBLESHOOTING B-82235EN/08 Symptom Description Cause Vibration Abnormal noise (Continued) The cause of problem cannot be identified from examination of the floor, rack, or mechanical unit. [Controller, cable, and motor] If a failure occurs in a controller circuit, preventing motor information as the motor cannot propagate the accurate position to the controller. If the motor becomes defective, vibration might occur because the motor cannot deliver its rated performance. If a power line in a movable cable of the mechanical unit has an intermittent break, vibration might occur because the motor cannot deliver its rated performance. Pulsecoder wire in a movable part of the mechanical unit has an intermittent break, vibration might occur because commands cannot be sent to the motor accurately. If a connection cable between the mechanical unit and the controller has an intermittent break, vibration might occur. occur. If the power source voltage drops below the rating, vibration might occur. It may vibrate when the invalid robot controller Maintenance Manual for troubleshooting related to the controller and amplifier. Replace the motor of the axis that is vibrating, and check whether vibration still occurs. For the method of replacement, refer to Chapter 4. If vibration occurs only when the robot assumes a specific posture, it is likely that a mechanical unit is broken. Shake the movable part cable while the robot is at rest, and check whether an alarm occurs. If an alarm or any other abnormality occurs, replace the mechanical unit cable Check whether the cable jacket connection still occurs. Check whether vibration still occurs. Check that the robot is supplied with the rated voltage Check that the robot control parameter is set to a valid value. If it is set to an invalid value, correct them. Contact your local FANUC representative for further information if necessary. 3.TROUBLESHOOTING Symptom B-82235EN/08 Description Vibration Noise (Continued) - Cause There is some relationship [Noise from a nearby machine] If the bunded between the vibration of the properly, electrical noise is robot and the operation of a induced on the grounding wire, machine near the robot is grounded at an unsuitable point, its grounding potential becomes unstable. likely to be induced on the grounding line, thus leading to vibration. There may be an abnormal noise There is an abnormal noise during operation of the specified grease. There is an abnormal noise Even for the specified grease, after a long time. there may be an abnormal noise There is an abnormal noise during operation at low speed during operation at low immediately after replacement or speed. after a long time. - 32 - Measure Connect the grounding wire firmly to ensure a reliable ground potential and prevent extraneous electrical noise. Use the specified grease. When there is an abnormal noise even for specified grease, operate for one or two days on an experiment. Generally, an abnormal noise will disappear. 3.TROUBLESHOOTING B-82235EN/08 Symptom Rattling Description - - Cause Measure Check the following [Mechanical unit mounting bolt] While the robot is not retaining bolts tightness for It is likely that overloading or a supplied with power, each axis. If any of these collision has loosened a mounting pushing it by hand wobbles bolts is loose, apply bolt in the robot mechanical unit. LOCTITE and bolt - Reducer retaining bolt - Reducer shaft retaining bolt - Reducer shaft retaining bolt - Arm retaining bolt - Casing retaining bolt - End effector retaining bolt - End effector retaining bolt Operate each axis at an Backlash is greater than the [Increase of backlash] individually to judge which It is likely that excessive force allowance stated in the axis has been vibrating. overloading, manual. check whether any of its has broken a gear or the inside of (See Section 3.2.) gears are broken. If any the reducer, resulting in an gear is broken, replace it. increase in the amount of Check whether any other backlash. there is no damaged gear, use wear the Gear and the replace the reducer. If the reducer is broken, or It is likely that prolonged use if a gear tooth is missing, without changing the grease from the to wear out, resulting in an gearbox and wash the increase in the amount. Using the replacing the gear or reducer, add an appropriate grease amount. Using the robot within its maximum rating prevent problems. - 33 -3.TROUBLESHOOTING Symptom Motor overheat B-82235EN/08 Description - - The motor overheated due to the temperature in the installation area rose. After a cover was attached to the motor, the motor overheated due to the temperature in the installation area rose. the motor overheated along with the ambient temperature rose, and could not release heat. [Operating condition] It is likely that the overcurrent above the specified permissive average current. - - - - [Parameter] If data input for a workpiece is invalid, the robot cannot be accelerated normally, so the average current increases, leading to overheat. Symptom other than stated [Mechanical unit problems] above It is likely that problems] It is likely that problems] It is likely that a failure of the motor brake resulted in the motor. [Motor problems] It is likely that a failure of the motor. motor. It is likely that a failure of the motor prevented it from delivering its rated performance, thus causing an excessive current to flow through the motor overheated. - 34 - - - - - Reducing the ambient temperature is the most effective means effect of preventing overheat. Having the surroundings of the motor well ventilated enables the motor to release heat efficiently, thus preventing overheat. If there is a source of heat near, it is advisable to install shielding to protect the motor from heat radiation. current. Thus, prevent overheat. The teach pendant can monitor the average current. Check the average current when the robot control program launched. As for load setting, input an appropriate parameter referring to Section 4.3 of the operator's manual. Repair the mechanical unit while referring to the above descriptions of vibration, abnorma noise, and rattling. Check that, when the servo system is energized, the brake is released. If the brake remains applied to the motor all the time, replace the motor. If the servo system is energized, the brake remains applied to the motor all the time, replace the motor. If the servo system is energized, the brake remains applied to the motor all the time, replace the motor. If the servo system is energized, the brake remains applied to the motor all the time, replace the motor. If the servo system is energized, the brake remains applied to the motor all the time, replace the motor. If the servo system is energized, the brake remains applied to the motor all the time, replace the motor all th Symptom Grease leakage Description - Grease leaks from the mechanical unit. Cause Measure [Poor sealing] Probable causes are a crack in the casting may crack with excessive force caused in collision. An O-ring can be damaged oil seal, or a loose seal bolt. The casting may crack with excessive force caused in collision. An O-ring can be damaged oil seal, or a loose seal bolt. assembling. An oil seal may be damaged if dust scratches the lip. A loose seal bolt may allow grease to leak along the threads. Problems with the grease nipple. - Dropping axis - An axis falls in standstill. [Brake drive relays are stuck to each other and keep the brake current flowing, thus preventing the brake from operating when the motor is reenergized. It is likely that the brake shoe has worn out or the brake from operating efficiently. It is likely that oil or grease soak through the motor, causing the brake to slip. - 35 - - - If a crack develops in the casting, sealant can be used as a quick-fix to prevent further grease or oil leakage. However, the component should be replaced as soon as possible, because the crack might enlarge. O-rings are used in the locations listed below. Motor coupling section Reducer (case and shaft) coupling section I3 arm coupling section Inside the wrist Oil seals are used in the locations stated below. Inside the reducer Inside the wrist Seal bolts are used in the locations stated below. Grease drain outlet Replace the relay. Replace the motor confirmed following symptoms. Brake shoe is worn out brake main body is damaged Oil soak through the motor 3.TROUBLESHOOTING Symptom Displacement B-82235EN/08 Description - - - BZAL alarm occurred Cause Measure The robot operates at a point other than the taught position. The repeatability is not within the tolerance. [Mechanical unit problems] If the repeatability is unstable, probable causes are a failure in the drive mechanism or a loose bolt, and so on. If the repeatability is stable, it is likely that collision by an excessive load caused slip on the mounting face of each axis arm, and reducer. It is likely that the Pulsecoder is abnormal. Displacement occurs only in a specific peripheral equipment. [Peripheral equipment equipment] displacement] It is likely that an external force was applied to the peripheral equipment, thus shifting its position relative to the robot. [Parameter] It is likely that the mastering data was rewritten in such a way that the robot. - The voltage of the memory backup battery may be low. The Pulsecoder cable may be broken. - 36 - - If the repeatability is unstable, repair the mechanical unit by referring to the above descriptions of vibration, noise, and rattling. If the repeatability is stable, correct the taught program. Variation will not occur unless another collision occurs. If the Pulsecoder is abnormal, replace the motor. Correct the setting of the peripheral equipment position. Correct the taught program. Re-enter the previous mastering data, which is known to be correct. If correct mastering data is unavailable, perform mastering data is unavailable, perform mastering data is unavailable. BACKLASH MEASUREMENT Measurement method 1 2 3 Maintain the robot in a specified posture. (See Table 3.2 (a) to (d) and Fig. 3.2 (b) to (k).) Apply positive and negative loads to each axis three times Average the values measured in the last two measurements for each axis, and use the averages as a measured backlash for the respective axes. Stop position 0 +10kgf Second step (B2 = L1 + L2) f L2 +10kgf 0kgf L3 -10kgf Third step (B3 = L3 + L4) 0kgf L4 Fig. 3.2 (a) Backlash measurement space is provided in the lower area ahead of the robot, for example, by installing the robot on the pedestal. - 38 - 3.TROUBLESHOOTING B-82235EN/08 1J1-axis measuring posture hen measuring backlash, press the dial gauge to the center of the end effector at right angles. 3149 Loading posiiton 2J2-axis measuring posture hen measuring backlash, press the dial gauge to the side of the J2 arm at right angles. When measuring backlash, press the dial gauge to the center of the end effector at right angles. 1280 1075 3J3-axis measuring posture Loading position Fig. 3.2 (b) Backlash measurement posture (1/2) (R-2000iB/165F/210F/185L/250F/210WE/125L/175L/150U/220U/165CF) NOTE Distance of Fig. 3.2 (b) is case of R-2000iB/165F. - 39 - 3.TROUBLESHOOTING B-82235EN/08 4J4-axis measuring posture Loading position When measuring backlash, press the dial gauge to the center of the end effector at right angles. 519 6J6-axis measuring posture 5J5-axis measuring posture When measuring backlash, press the dial gauge to the center of the end effector at right angles. 519 6J6-axis measuring posture 5J5-axis measuring posture When measuring backlash, press the dial gauge to the center of the end effector at right angles. 519 6J6-axis measuring posture 5J5-axis measuring backlash, press the dial gauge to the center of the end effector at right angles. 519 6J6-axis measuring posture 5J5-axis measuring backlash, press the dial gauge to the center of the end effector at right angles. 519 6J6-axis measuring posture 5J5-axis measuring backlash, press the dial gauge to the center of the end effector at right angles. 519 6J6-axis measuring posture 5J5-axis measuring posture When measuring backlash, press the dial gauge to the center of the end effector at right angles. 519 6J6-axis measuring posture 5J5-axis J2-axis cannot be measured. - 40 - NOTE 3.TROUBLESHOOTING B-82235EN/08 When measuring backlash, 1J1-axis measuring position 1768 2J3-axis measuring posture Loading position When measuring backlash, press the dial gauge to the center of the end effector at right angles. effector at right angles. Fig. 3.2 (d) Backlash measurement posture (1/2) (R-2000iB/165R/200R) NOTE Distance of Fig. 3.2 (d) is case of R-2000iB/165R. - 41 - 3.TROUBLESHOOTING B-82235EN/08 3J4-axis measuring posture When measuring backlash, press the dial gauge to the center of the end effector at right angles. 4J5-axis measuring posture 519 Loading position Loading position When measuring backlash, press the dial gauge to the center of the end effector at right angles. 519 5J6-axis measuring posture When measuring backlash, press the dial gauge to the center of the end effector at right angles. 301 Loading position Fig. 3.2 (e) Backlash measurement posture (2/2) (R-2000iB/165R/200R) - 42 - 3.TROUBLESHOOTING B-82235EN/08 1J1-axis measuring posture 4101 When measuring backlash, press the dial gauge to the center of the end effector at right angles. Fig. 3.2 (f) Backlash measurement posture (1/2) (R-2000iB/100P) - 43 - 3.TROUBLESHOOTING B-82235EN/08 3J4-axis measuring posture When measuring posture Loading position 885 4J5-axis measuring backlash, press the dial gauge to the center of the end effector at right angles. 5J6-axis measuring posture Loading position 935 When measuring backlash, press the dial gauge to the center of the end effector at right angles. Fig. 3.2 (g) Backlash measurement posture (2/2) (R-2000iB/100P) - 44 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (c) Backlash measurement posture (R-2000iB/170CF) Measured axis J1 J2 J3 J4 J5 J6 Posture J1 Any angle Any an center of the end effector at right angles. 2039 Loading position J2-axis measuring posture J3-axis measuring posture 550 369 Loading position When measuring backlash, press the dial gauge to the side of the J2 arm at right angles. Fig 3.2 (h) Backlash measurement posture (1/2) (R-2000iB/170CF) - 45 - 3.TROUBLESHOOTING B-82235EN/08 J4-axis measuring position When measuring backlash, press the dial gauge to the center of the end effector at right angles. J6-axis measuring posture J5-axis measuring posture Loading position Loading position When measuring backlash, press the dial gauge to the center of the end effector at right angles. J6-axis measuring posture J5-axis measuring posture Loading position Loading position When measuring backlash, press the dial gauge to the center of the end effector at right angles. J6-axis measuring posture J5-axis measuring posture Loading position When measuring backlash, press the dial gauge to the center of the end effector at right angles. J6-axis measuring posture J5-axis measuring posture Loading position Loading position When measuring backlash, press the dial gauge to the center of the end effector at right angles. J6-axis measuring posture Loading position Loading position When measuring backlash, press the dial gauge to the center of the end effector at right angles. J6-axis measuring posture Loading position Loading position When measuring backlash, press the dial gauge to the center of the end effector at right angles. J6-axis measuring posture Loading position Loading position When measuring backlash, press the dial gauge to the center of the end effector at right angles. 519 301 When measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (d) Backlash measurement posture (2/2) (R-2000iB/170CF) - 46 - 3.TROUBLESHOOTING B to the center of the end effector at right angles. 403 (J4) 4J4,J5-axis measuring position When measuring backlash, press the dial gauge to the center of the end effector at right angles. Fig. 3.2 (k) Backlash measuring backlash, press the dial gauge to the center of the end effector at right angles. Fig. 3.2 (k) Backlash measuring ba (e) Backlash allowance (R-2000iB/165F) Angle conversion (arc-min) Displacement conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.25 2.00 0.63 2.00 0.74 2.38 0.36 3.30 0.50 6.43 0.56 3149 1075 1280 519 301 Table 3.2 (f) Backlash allowance (R-2000iB/210F/210WE) Angle conversion (arc-min) Displacement conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.25 2.00 0.63 2.00 0.74 2.38 0.36 3.30 0.50 6.43 0.56 3149 1075 1280 519 301 Table 3.2 (f) Backlash allowance (R-2000iB/210F/210WE) Angle conversion (arc-min) Displacement conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.25 2.00 0.63 2.00 0.74 2.38 0.36 3.30 0.50 6.43 0.56 3149 1075 1280 519 301 Table 3.2 (f) Backlash allowance (R-2000iB/210F/210WE) Angle conversion (arc-min) Displacement conversion (arc-min) Displacement conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.25 2.00 0.63 2.00 0.74 2.38 0.36 3.30 0.50 6.43 0.56 3149 1075 1280 519 301 Table 3.2 (f) Backlash allowance (R-2000iB/210F/210WE) Angle conversion (arc-min) Displacement convers Displacement conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.27 2.00 0.63 2.00 0.74 2.29 0.37 2.99 0.48 5.56 0.60 3178 1075 1280 548 370 Table 3.2 (g) Backlash allowance (R-2000iB/185L) Angle conversion (arc-min) Displacement co gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.60 2.00 0.63 2.00 0.63 2.00 0.63 2.00 0.63 2.00 0.63 2.00 0.63 2.00 0.63 2.00 0.63 2.00 0.74 2.29 0.34 2.99 0.34 2.99 0.34 2.99 0.52 5.56 0.67 3633 1075 1690 593 593 416 Table 3.2 (h) Backlash allowance (R-2000iB/250F) Angle conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.24 2.00 0.63 2.00 0.74 2.29 0.34 2.99 0.34 2.99 0.34 2.99 0.52 5.56 0.67 3633 1075 1690 593 593 416 Table 3.2 (h) Backlash allowance (R-2000iB/250F) Angle conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.24 2.00 0.63 2.00 0.74 2.29 0.34 2.99 0.34 2.99 0.54 2.99 0.54 2.99 0.55 160 0.57 1690 593 593 416 Table 3.2 (h) Backlash allowance (R-2000iB/250F) Angle conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.24 2.00 0.63 2.00 0.74 2.29 0.34 2.99 0.34 2.99 0.54 2.99 0.54 2.99 0.55 160 0.57 1690 593 593 416 Table 3.2 (h) Backlash allowance (R-2000iB/250F) Angle conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.24 2.00 0.63 2.00 0.74 2.29 0.34 2.99 0.54 2.99 0.54 2.99 0.55 160 0.57 1690 593 593 416 Table 3.2 (h) Backlash allowance (R-2000iB/250F) Angle conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.46 2.49 0.57 1690 593 593 416 Table 3.2 (h) Backlash allowance (R-2000iB/250F) Angle conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.49 0.57 1690 593 593 416 Table 3.2 (h) Backlash allowance (R-2000iB/250F) Angle conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.47 1690 593 593 416 Table 3.2 (h) Backlash allowance (R-2000iB/250F) Angle conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.49 1690 593 593 416 Table 3.2 (h) Backlash allowance (R-2000iB/250F) Angle conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 0.44 5.56 0.50 3136 1075 1280 506 506 310 Table 3.2 (i) Backlash allowance (R-2000iB/165R) Angle conversion (arc-min) Displacement conversion 2000iB/200R) Angle conversion (arc-min) Displacement conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.38 ---- 2.00 0.98 2.29 0.37 2.99 0.48 5.56 0.60 3328 --- 1682 548 548 370 Table 3.2 (k) Backlash allowance (R-2000iB/100P) Angle conversion (arc-min) Displacement conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.93 ----- 2.00 1.50 2.29 0.59 2.99 0.48 5.56 0.60 4101 --- 2575 885 885 935 - 49 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (l) Backlash allowance (R-2000iB/170CF) Angle conversion (arc-min) Displacement conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.93 ---- 2.00 1.50 2.29 0.59 2.99 0.48 5.56 0.60 4101 --- 2575 885 885 935 - 49 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (l) Backlash allowance (R-2000iB/170CF) Angle conversion (arc-min) Displacement conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.93 ---- 2.00 1.50 2.29 0.59 2.99 0.48 5.56 0.60 4101 --- 2575 885 885 935 - 49 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (l) Backlash allowance (R-2000iB/170CF) Angle conversion (arc-min) Displacement conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.93 ---- 2.00 1.50 2.99 0.48 5.56 0.60 4101 --- 2575 885 885 935 - 49 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (l) Backlash allowance (R-2000iB/170CF) Angle conversion (arc-min) Displacement conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.93 ---- 2.00 1.50 2.99 0.48 5.56 0.60 4101 --- 2575 885 885 935 - 49 - 3.TROUBLESHOOTING B-82235EN/08 Table 3.2 (l) Backlash allowance (R-2000iB/170CF) Angle conversion (mm) Displacement conversion (mm) gauge (mm) J1 J2 J3 J4 J5 J6 2.46 1.46 2.00 0.32 2.97 0.32 2.37 0.36 3.31 0.50 6.42 0.56 2039 550 369 519 519 301 Table 3.2 (m) Backlash allowance (R-2000iB/125L) Angle conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.41 2.00 0.63 2.00 0.95 2.39 0.29 3.33 0.40 6.44 0.56 3368 1075 1635 412 412 299 Table 3.2 (n) Backlash allowance (R-2000iB/175L) Angle conversion (arc-min) Displacement conversion (arc-min) Displacement conversion (mm) J1 J2 J3 J4 J5 J6 2.46 2.40 2.00 0.63 2.00 0.86 2.29 0.35 2.99 0.45 5.56 0.49 3349 1075 1480 519 519 301 Table 3.2 (o) Backlash allowance (R-2000iB/175L) 2000iB/100H) Angle conversion (arc-min) Displacement conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 2.49 2.19 2.00 0.63 2.00 0.74 7.91 0.93 8.30 0.51 3033 1075 1280 403 212 Table 3.2 (p) Backlash allowance (R-2000iB/150U) Angle conversion (arc-min) Displacement conversion (mm) Distance between the rotation center and dial gauge (mm) [1 J2 J3 J4 J5 J6 2.46 2.25 2.00 0.63 2.00 0.74 2.38 0.36 3.28 0.49 6.43 0.56 3148 1075 1280 518 518 302 Table 3.2 (q) Backlash allowance (R-2000iB/220U) Angle conversion (arc-min) Displacement conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.25 2.00 0.63 2.00 0.74 2.38 0.36 3.28 0.49 6.43 0.56 3148 1075 1280 518 518 302 Table 3.2 (q) Backlash allowance (R-2000iB/220U) Angle conversion (arc-min) Displacement conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.46 2.12 2.00 0.63 2.00 0.74 2.29 0.37 2.99 0.48 5.56 0.60 2963 1075 1280 548 548 370 Table 3.2 (r) Backlash allowance (R-2000iB/165CF) Angle conversion (mm) Distance between the rotation center and dial gauge (mm) J1 J2 J3 J4 J5 J6 2.40 1.33 2.00 0.32 2.00 0.52 2.14 0.32 3.28 0.49 7.28 0.62 1912 550 887 513 513 294 NOTE 1 When measuring backlash under circumstances where the distance between the rotation center and the dial gauge is different from those in the above table. 2 For the R-2000iB/165R/200R/100P the balancer force or gravity is always applied to the J2-axis, so the backlash of the J2-axis cannot be measured. - 50 - 4.REPLACING PARTS B-82235EN/08 4 REPLACING PARTS This section describes the replacement procedures for the major components, be sure to follow the respective procedures. See Chapter 5 for how to replace the cables and limit switches. 4.1 FIGURE OF DRIVE MECHANISM The drive mechanisms of each axis are shown in the following. [1-axis motor (M1) Input gear Pipe [1 base]2 base [1-axis (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L/100H/150U/220U) - 51 - 4.REPLACING PARTS B-82235EN/08 [1 axis motor (M1) Input gear Pipe Center gear Table J1 base J1-axis reducer Fig. 4.1 (c) Drive mechanism of J2-axis reducer Fig. (d) Drive mechanism of J3-axis (R-2000iB/165F/210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H/150U/220U/165CF) Input gear J3-axis (R-2000iB/170CF) - 53 - 4.REPLACING PARTS B-82235EN/08 J4-axis motor (M4) Center gear Wrist unit Drive shaft J4-axis reducer Pinion gear Fig. 4.1 (f) Drive mechanism of J4-axis (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L/150U/220U/165CF) J6-axis reducer J6-axis drive shaft J5-axis Drive mechanism of J5 and J6-axis (J4 and J5-axis in case of R-2000iB/100H) - 54 - 4.REPLACING PARTS B-82235EN/08 4.2 NOTE FOR PART REPLACEMENT Once motors, reducers, and gears are replaced. Be very careful when carrying and assembling the heavy components listed below. Table 4.2 (a) Weight of the main parts (1/2) Weight (approximate) Component M1 Servo motors M2, M3 M2 M4, M5, M6 J1-axis J2-axis Reducers J3-axis J4-axis 165F/210F/185L/250F/165R/200R/100P /210WE/125L/175L/100H/150U/220U 25kg 170CF 165CF 10kg 30kg 165F/210F/185L/250F/165R/200R/100P /210WE/170CF/125L/175L/100H/150U/220U 30kg 35kg 170CF/165CF 165F/210F/185L/250F/165R/200R/100P /210WE/125L/175L/100H/150U/220U 10kg 165CF 220U 10 165F/210F/165R/200R/100P/170CF/210WE /125L/175L/220U 165CF 165F/165R/100P/170CF/220U 165CF 165F/165R/100P/170CF/2 165F/210F/185L/250F/210WE/125L/100H 210F/210WE/125L/100H 210F/200R/100P 170CF 165CF 150kg 71kg 100kg Balancer 165F/125L/100H 210F/210WE/175L 185L/250F/200R/100P 170CF 165CF 150kg 71kg 100kg Balancer 165F/125L/100H 210F/210WE/175L 185L/250F/200R/100P 170CF 165CF 55kg - 55 Remarks 4.REPLACING PARTS B-82235EN/08 Table 4.2 (b) Weight of the main parts (2/2) Weight (approximate) Component J2 base to wrist unit 165F/150U 790kg 210F 185L 250F/220U 165R 200R 100P 170CF 210WE 125L 175L 100H 165CF 165F/150U 845kg 870kg 860kg 810kg 860kg 810kg 865kg 770kg 860kg 810kg 865kg 770kg 860kg 810kg 865kg 770kg 865kg 770kg 800kg 810kg 865kg 770kg 800kg 710kg 435kg 210F/250F/220U 490kg 185L 165R 200R 100P 170CF 125L 175L 210WE 100H 165CF 165F/165R/150U 505kg 450kg 450kg 370kg 295kg 210F/200R/210WE/220U 185L 250F 100P J3 casing to wrist unit 170CF 125L 175L 100H 165CF 125L 175L 200WE 375kg 360kg 375kg 360kg 370kg 370kg 370kg 295kg 10F/200R/210WE/220U 185L 250F 100P J3 casing to wrist unit 170CF 125L 175L 100H 165CF 125L 175L 200WE 375kg 360kg 375kg 360kg 370kg 370kg 370kg 370kg 370kg 295kg 450kg 205kg 315kg 380kg 275kg 270kg 180kg 200kg Remarks J1-axis motor and the balancer are not included. J2-axis reducer is not included. Per 1 cabinet In case of reusing seal bolts. (However, seal tape needs to be wound around the seal bolts used as a plug.) Notice the following 1 note. Remove excessive bits of sealant on the seal bolts. - 56 - 4.REPLACING PARTS B-82235EN/08 NOTE When applying LOCTITE to a part, spread the LOCTITE on the entire length area of the engaging part of the female threads, poor adhesion can occur potentially loosening the bolt. Clean the bolts and the threaded holes. In this case, remove all the excess LOCTITE when you are finished screwing the bolts into the threaded holes. NOTE 1 Description of [LT243] means LOCTITE 243. 2 Description of [LT263] means LOCTITE 263. 3 Description of [LT518] means LOCTITE 518. 4.3 REPLACING THE J1-AXIS MOTOR (M1) AND REDUCER Replacing J1-axis motor (M1) (R-2000iB/165F/210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H) Remove 1 2 3 4 5 6 7 8 9 Set dial gauges at the J1-axis, and prepare for single axis mastering after replacement. Turn off the controller power. Remove the motor cover when it is attached. (See Section REPLACING MOTOR COVERS) When a fan is not attached, remove the Pulsecoder connector cover (2). (The cover turns together with the bolts, possibly causing damage to the connector. Hold the cover to prevent it from turning. When fan is mounted, remove the fan. (See Section 4.7 REPLACING THE FANS.) Remove three connectors of the motor (1) from the J2 base vertically, while being careful not to scratch the surface of the input gear (6) teeth. Remove the bolt (10), washer (9), and O-ring (11) from the shaft of the motor (1). Exchange the bearing (7), C ring (8) from the shaft of the motor (1). Exchange the bearing (7) and the C is a construction of the motor (1). Exchange the bearing (7) and the C is a construction of the motor (1). Exchange the bearing (7) and the C is a construction of the motor (1). Exchange the bearing (7) and the C is a construction of the motor (1). Exchange the bearing (7) and the C is a construction of the motor (1). Exchange the bearing (7) and the C is a construction of the motor (1). Exchange the bearing (7) and the C is a construction of the motor (1). Exchange the bearing (7) and the C is a construction of the motor (1). Exchange the bearing (7) and the C is a construction of the motor (1) is a construction of the motor (1). Exchange the bearing (7) and the C is a construction of the motor (1) is a construction of th rings (8) if these have been damaged. Attach the bearing (7) and the C ring (8) to the input gear (6) by using the jig (A290-7329-X921). (See Fig. 4.3 (a) Bearing presser.) Mount the motor (1) on the J2 base vertically while being careful not to damage the tooth surface of input gear (6). Attach the three motor mounting bolts (4) and washers (5). Attach the motor cover when it was (See Section 4.10 REPLACING MOTOR COVERS) Perform single axis mastering referring to Section 8.6 of the Operator's Manual. - 57 - 4.REPLACING PARTS B-82235EN/08 4 5 2 3 1 A290-7329-X921 Bearing pressure (67 8 9 10 11 Parts name 1 MOTOR 2 COVER 3 BOLT 4 BOLT 5 WASHER 6 INPUT GEAR 7 8 9 10 BEARING C RING WASHER BOLT 11 O-RING Specifications Except 210WE A6-BA-8X16SUS Except 210WE A6-BA-8X16SUS Except 210WE A6-BA-8X16SUS Except 210WE A6-BA-8X16SUS Except 210WE A97L-0218-0432#M12H Except 210WE A97L-0218-0432#M12H Except 210WE A97L-0218-0432#M12H Except 210WE A6-BA-8X16SUS Except 210WE A97L-0218-0432#M12H Except 210WE A97L-0218-0444 0801#229 100H A97L-0218-0801#184 A97L-0001-0196#08Z000A A6-CJR-40 (Attached to INPUT GEAR) (Atta 2000iB/165F/210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H) - 58 - 4.REPLACING PARTS B-82235EN/08 Replacing J1-axis motor (M1) (R-2000iB/170CF) (In case of robot made after Feb., 2011) Remove 1 2 3 4 5 6 7 8 9 Set dial gauges at the J1-axis, and prepare for single axis mastering after replacement. Turn off the controller power. Remove the motor cover when it is attached. (See Section REPLACING MOTOR COVERS) Remove the bolt (2), (4), and then remove the Pulsecoder connectors of the motor (1). Remove the bolt (2), (4), and then remove the bolt (2), (4), and then remove the pulsecoder connector cover (3), (5). (The cover turns together with the bolts, possibly causing damage to the connector. Hold the cover to prevent it from turning.) Remove the pulsecoder connector cover (3), (5). (The cover turns together with the bolts, possibly causing damage to the connector. four motor mounting bolts (6) and then remove the washers (7). Pull out the motor (1) from the J2 base vertically, while being careful not to scratch the surface of the input gear (11) [with C ring (8), bearing (9)] and draw nut (10) from the shaft of the motor (1). Assembling 1 2 3 4 5 6 7 8 9 Polish the flange surface of the motor (1) using an oilstone. Mount the input gear (11) [with C ring (8) or the bearing (9)] and draw nut (10) on the shaft of the motor (1). Exchange the C ring (8) or the bearing (9) if these have been damaged. Attach the C ring (8) and the bearing (9) to the input gear (11) by using the jig (A290-7329-X921). (See Fig. 4.3 (a) Bearing presser.) Mount the bolt (13) and the new seal washer (12) on the four motor (1). Place the new O-ring (14) in the specified position, and mount the motor (1). Place the new O-ring (14) in the specified position, and mount the four motor (1) and the new seal washer (12) on the motor (1) on the J2 base vertically while being careful not to damage the surface of the teeth of the input gear (11). Attach the four motor mounting bolts (6) and washers (7). Attach the motor cover (3), (5). Attach the Pulsecoder connector cover (3), (5). Attach the motor cover (3), (5). Attach the moto 6 7 1 8 9 10 11 12 13 14 Parts name 1 2 3 4 5 6 7 8 9 10 11 12 13 14 MOTOR BOLT COVER BO A97L-0001-0196#08Z000A A290-7329-X203 A290-7329-Y202 1 2 1 3 1 4 4 1 1 1 1 A30L-0001-0048#6SUS-2 1 A6-BA-6X85 JB-OR1A-G105 1 1 Locking Torque N-m (kgf-m) 2.0 (0.20) LT243 LT243 Fig. 4.3 (b) Replacing J1-axis motor (M1) (R-2000iB/170CF made after Feb., 2011) - 60 - 15.7 (1.6) 4.REPLACING PARTS B-82235EN/08 (In case of robot made before [an,2011] Remove 1 2 3 4 5 6 7 8 9 Set dial gauges at the [1-axis, and prepare for single axis mastering after replacement. Turn off the controller power. Remove the bolt (2), (4), and then remove the Pulsecoder connector cover (3), (5). (The cover turns together with the bolts, possibly causing damage to the connector. Hold the cover to prevent it from turning.) Remove three connectors of the motor (1) with block (9) from the J2 base vertically, while being careful not to scratch the surface of the input gear (13) teeth. Remove the bolt (15), seal washer (14), and O-ring (16) from the shaft of the motor (1). Pull off the input gear (13) [with C ring (10), bearing (11)] and draw nut (12) from the shaft of the motor (1). And separate motor (1) from block (9). Assembling 1 2 3 4 5 6 7 8 9 10 Polish the flange surface of the motor (1) using an oilstone. Mount the draw nut (12) on motor shaft. Place the new O-ring (8) to block (9), and insert motor (1) to block (9). Mount the input gear (13) by using the jig (A290-7329-X921). (See Fig. 4.3 (a) Bearing presser.) Mount the bolt (15) and the new seal washer (14) on the motor (1). Place the new O-ring (16) in the specified position, and mount the motor (1) and block (9) on the J2 base vertically while being careful not to damage the surface of the teeth of the input gear (13). Confirm by turning the motor (1) lightly that the motor (1) doesn't lean and the motor shaft isn't subjected to too much stress. Attach the four motor cover (3), (5). Attach the motor cover (3), (5). Attach the motor (1). Attach the four motor mounting bolts (6) and washers (7). single axis mastering referring to Section 8.6 of the Operator's Manual. - 61 - 4.REPLACING PARTS B-82235EN/08 2 3 4 5 1 6 7 8 9 10 11 12 13 14 15 16 MOTOR BOLT COVER BOLT Specifications Q'ty A06B-0235-B605#S000 A6-BA-4X6 A860-2000-X037 A6-BA-4X18 A860-2000-X036 A6-BA-8X70 A97L-0001-0823#M8H JB-OR1A-G105 A290-7329-X206 A6-CJR-40 A97L-0001-0196#08Z000A A290-7329-X203 A290-7329-Y202 1 2 1 3 1 4 4 1 1 1 1 1 A30L-0001-0048#6SUS-2 1 A6-BA-6X85 JB-OR1A-G105 1 1 Locking Torque N-m (kgf-m) 2.0 (0.20) LT243 LT243 15.7 (1.6) Fig. 4.3 (c) Replacing J1-axis motor (M1) (R-2000iB/170CF made before Jan., 2011) - 62 - 4.REPLACING PARTS B-82235EN/08 Replacing J1-axis motor (M1) (R-2000iB/150U/220U) Remove 1 2 3 4 5 6 7 8 9 Set dial gauges at the J1-axis, and prepare for single axis mastering after replacement. Turn off the controller power. Remove the motor cover when it is attached. (See Section REPLACING MOTOR COVERS) When fan is not mounted, remove the fan. (See Section 4.7 REPLACING THE FANS.) Remove three connectors of the motor (1). Remove three motor mounting bolts (4) and then remove the washers (5). Pull out the motor (1) [with plate (7), input gear (8), bearing (9), and C ring (10)] from the J2 base vertically, while being careful not to scratch the surface of the input gear (8) teeth. Remove the bolt (12), seal washer (11), and O-ring (13) from the shaft of the motor (1). Pull off the input gear (8) [with bearing (9), C ring (10)] from the shaft of the motor (1) and then remove the plate (7) and the pl on the motor (1). Mount the input gear (8) [with bearing (9), C ring (10)] on the shaft of the motor (1). Exchange the bearing (9) or the C rings (10) to the input gear (8) by using the jig (A290-7329-X921). (See Fig. 4.3 (a) Bearing presser.) Mount the bolt (12) and the new seal washer (11) on the motor (1). Place the new O-ring (13) in the specified position, and mount the motor (1) on the J2 base vertically while being careful not to damage the surface of the teeth of the input gear (8). Attach the three motor mounting bolts (4) and washers (5). Attach the three motor mounting bolts (4) and washers (5). cover (2). When fan was mounted, mount the fan. (See Section 4.7 REPLACING THE FANS.) Attach the motor cover when it was attached. (See Section 8.6 of the Operator's Manual. - 63 - 4.REPLACING PARTS B-82235EN/08 4 5 3 2 1 6 7 8 9 10 11 12 13 Parts name 1 2 3 4 5 6 7 8 9 10 11 12 13 MOTOR BOLT COVER BOLT WASHER O-RING PLATE INPUT GEAR BEARING C RING SEAL WASHER BOLT O-RING Specifications Q'ty A06B-0041-B605#S042 A6-BA-8X16 A290-7329-X205 A290-7329-X205 A290-7329-X204 A97L-0001-0196#08Z000A A6-CJR-40 1 1 1 3 3 1 1 1 1 A30L-0001-0048#6SUS-2 1 A6-BA-6X145 JR-OR1A-G125 1 1 Locking Torque N-m (kgf-m) LT243 15.7 (1.6) Fig. 4.3 (d) Replacing J1-axis motor (M1) (R-2000iB/165CF) Remove 1 2 3 4 5 6 7 8 Set dial gauges at the J1-axis, and prepare for single axis mastering after replacement. Turn off the connector cover (2). (The cover turns together with the bolts, possibly causing damage to the connector. Hold the cover turns together with the bolts, possibly causing damage to the connector. washers (5). Pull the motor (1) vertically out of the J1-aixs base while being careful not to damage the surface of the motor (1). Remove the gear (6) from the shaft of the motor (1). Assembling 1 2 3 4 5 6 7 8 Polish the flange surface of the motor (1) using an oilstone. Attach the gear (6) to the shaft of the motor (1). Attach the nut (8) and washer (7) to the motor (1). Place the new O-ring (9) in the specified position, and mount the motor (1) on the II base vertically while being careful not to damage the surface of the gear teeth. Attach the four motor mounting bolts (4) and washers (5). Attach the three connectors to the motor (1). Attach the Pulsecoder connector cover (2). Perform single axis mastering referring to Section 8.6 of the Operator's Manual. - 65 - 4.REPLACING PARTS Parts name 1 2 3 4 5 6 7 8 9 MOTOR COVER BOLT BOLT WASHER II GEAR 1 WASHER NUT O-RING B-82235EN/08 Specifications A06B-0267-B605#S000 A290-7324-X101 A6-BA-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L /100H/150U/220U) WARNING The special tools. If the robot is hung without using the special tools, the robot can fall. Tools to replace the J1-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L/100H/150U/220U) Parts name Guide pin Spring pin striking tool Guide pin Spring pin striking Hanging jig right Hanging jig left Specification Q'ty A290-7329-X922 A 290-7329-X923 1 1 Tools to replace the J1-axis reducer (R-2000iB/165R/200R/100P) Parts name Hanging jig right Specification Q'ty A290-7329-X922 2 Tools to replace the J1-axis reducer (R-2000iB/165R/200R/100P) Parts name Hanging jig side Specification Q'ty A290-7329-X922 2 Tools to replace the J1-axis reducer (R-2000iB/165R/200R/100P) Parts name Hanging jig right Specification Q'ty A290-7329-X922 2 Tools to replace the J1-axis reducer (R-2000iB/165R/200R/100P) Parts name Hanging jig right Specification Q'ty A290-7329-X922 A 290-7329-X922 A 290-7329-X92A A 290-73 7329-X922 A290-7329-Z922 1 1 Remove 1 2 3 4 5 6 7 8 9 10 11 When robot is top mount, take robot down from top mount rack and fix it on the floor. Set dial gauges at the J1-axis, and prepare for single axis mastering after replacement. Set the Quick Master Reference Position referring to Section 8.4 of the Operator's Manual. (All the axes are set to 0° before shipment.) Remove loads such as the hand and workpiece from the wrist. Remove the balancer.) (For R-2000iB/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U) Ensure that the robot assumes the posture shown in Fig.4.3 (g). (For the R-2000iB/165R/200R/100P) Remove plate of J2 base side referring to Fig.4.3 (i). (For the R-2000iB/170CF) Ensure that the robot assumes the posture shown in Fig.4.3 (j). Turn off the controller power. Remove the J1-axis motor according to the previous item. Remove the connector panel from the back of the J1 base, then detach the connector. Remove the J1 base cable clamp and the J2 base cable clamp, then pull out the cable from the center pipe toward the J2 base. (See Section 5.3 REPLACING CABLE.) Remove the bolt (5), then remove the plate (4). Remove the bolt (8) and washer (7), then remove the stopper (6). - 67 - 4.REPLACING PARTS 12 13 14 B-82235EN/08 (For R-2000iB/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U) According to Fig. 4.3 (g), install the hanging jigs (A290-7329-X922, A290-7329-X923) onto the robot to be hung. The hanging jig for the left side and the hanging jig for the right side are not identical. Instead, the installation directions of the hanging jigs are predetermined. Install the hanging jigs so that the hole of each hanging jigs are predetermined. Install the hanging jigs so that the hole of each ha the robot to be hung. (For the R-2000iB/170CF) According to Fig.4.3 (j), install the hanging jigs (A290-7329-X922, A290-7329-Z922) onto the robot to enable the robot to be hung. Remove the J2 base mounting bolt (1) and washer (2), and hang the main robot unit for separation from the J1 unit. At this time, be careful not to damage the oil seal (9). The J2 base and J1-axis reducer are positioned with the spring pin (3). Be careful when handing the robot. Remove the reducer. If oil seal (9) is broken, break and remove it and press-fit new oil seal using fixture as Fig.1.9 (a). Assembling 1 2 3 4 5 6 7 8 9 10 Polish the mounting surface of the J1 base reducer with an oilstone. After attaching the new O-ring (13) to the reducer (12), mount the reducer removed. Apply the sealant in the form of beads to the shaft surface of the reducer as Fig. 4.3 (m). See Section 4.9. Place the main robot unit on the J1 unit by using the spring pin (3) with the sp fastening with the J2 base mounting bolt (1) and washer (2). At this time, check that the oil seal (9) is installed in position, and ensure that the lip is not turned up when the robot is installed. Install the plate (4) and stopper (6) in position. Lay the cables neatly, and fasten the J1 base clamp and J2 base clamp. See Section 5.3 REPLACING CABLE. Fasten the J1-axis motor as the previous item. Attach the connector onto the connector panel on the back of the J1 base, then attach the cable for connection between the controller and the robot. Mount the balancer onto the robot according to Section 4.8. Apply grease. (See Section 2.3.) CAUTION If greasing is performed before the sealant hardens grease leakage can occur. Before performing grease inlet, wait one hour or more after installation. If grease inlet, check that the overflows through the grease inlet, check that the overflows through the grease inlet. 11 Perform quick mastering, then perform single axis mastering to J1-axis referring to Section 8.4 and 8.5 of the Operator's Manual. NOTE When the influence of the damaged pieces generated from broken reducer is concerned about, exchange input gear and bearing of J1-axis. - 68 - 4.REPLACING PARTS B-82235EN/08 1 2 3 9 4 5 7 8 10 11 6 12 13 14 16 15 17 (Referring to Section 8.4 and 8.5 of the Operator's Manual. NOTE When the influence of the damaged pieces generated from broken reducer is concerned about, exchange input gear and bearing of J1-axis. - 68 - 4.REPLACING PARTS B-82235EN/08 1 2 3 9 4 5 7 8 10 11 6 12 13 14 16 15 17 (Referring to Section 8.4 and 8.5 of the Operator's Manual. NOTE When the influence of the damaged pieces generated from broken reducer is concerned about, exchange input gear and bearing of J1-axis. 2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/125L/175L/100H/150U/220U) Parts name 1 2 3 4 5 6 7 8 9 10 11 BOLT WASHER SPRING PIN PLATE BOLT OIL SEAL BOLT WASHER SPRING PIN PLATE BOLT STOPPER WASHER BOLT OIL SEAL BOLT WASHER SPRING PIN PLATE BOLT STOPPER WASHER BOLT OIL SEAL BOLT WASHER SPRING PIN PLATE BOLT STOPPER WASHER BOLT OIL SEAL BOLT WASHER SPRING PIN PLATE BOLT STOPPER WASHER BOLT OIL SEAL BOLT WASHER SPRING PIN PLATE BOLT STOPPER WASHER BOLT OIL SEAL BOLT WASHER B 0823#M12H A6-BA-12X35 A98L-0040-0047#13016014 A6-BA-12X85 A97L-0001-0823#M12H A97L-0218-0382#320CA229 12 13 14 15 16 17 REDUCER O-RING BOLT WASHER PIPE O-RING A97L-0218-0382#320CA229 12 13 14 15 16 17 REDUCER O-RING A97L-0218-0382#320CA229 12 13 14 15 16 17 REDUCER O-RING A97L-0218-0382#320CA229 12 13 14 15 16 17 REDUCER O-RING A97L-0218-0382#320CA29 12 13 14 15 16 17 REDUCER O-RING A97L-0218-0382#300A97L-0218-0382#300A97L-0218-0382#300A97L-0218-0382#300A97L-0218-0382#300A97L-0218-0382#300A97L-0218-0382#300A97L-0218-0382#300A97L-0218-0382#300A97L-0218-0382#300A97L-0218-0382#300A97L-0218-0382#300A97L-0218-0382#300A97L-0218-0384-0384-0384-0

170CF/100H/150U /220U 100H 170CF/150U/220U Q'ty Locking 12 12 1 1 2 1 4 4 1 16 16 LT263 Torque N-m (kgf-m) 318 (32.5) LT263 128 (13.1) 1 1 4 4 1 1 - 69 - 4.REPLACING PARTS B-82235EN/08 (R-2000iB/210WE) Parts name BOLT WASHER SPRING PIN STOPPER WASHER BOLT OIL SEAL BOLT WASHER REDUCER O-RING BOLT WASHER BOLT WASHER SPRING PIN STOPPER WASHER BOLT OIL SEAL BOLT WASHER REDUCER O-RING BOLT WASHER BOLT WASHER BOLT OIL SEAL BOLT WASHER REDUCER O-RING BOLT WASHER BOLT WASHER SPRING PIN STOPPER WASHER BOLT OIL SEAL BOLT WASHER REDUCER O-RING BOLT WASHER BOLT WASHER SPRING PIN STOPPER WASHER BOLT OIL SEAL BOLT WASHER REDUCER O-RING BOLT WASHER BOLT WASHER SPRING PIN STOPPER WASHER BOLT OIL SEAL BOLT WASHER REDUCER O-RING BOLT WASHER BOLT WASHER BOLT B-82235EN/08 (R-2000iB/210WE) Parts name BOLT WASHER SPRING PIN STOPPER WASHER BOLT WASHER REDUCER O-RING BOLT WASHER BOLT WASHER BOLT B-82235EN/08 (R-2000iB/210WE) Parts name BOLT WASHER SPRING PIN STOPPER WASHER BOLT WASHER REDUCER O-RING BOLT WASHER BOLT B-82235EN/08 (R-2000iB/210WE) Parts name BOLT WASHER SPRING PIN STOPPER WASHER BOLT B-82235EN/08 (R-2000iB/210WE) PARTS PIPE O-RING A97L-0218-0432#16X50 A97L-0218-0435#M16H A6-PS-12X30 A290-7329-X215 A97L-0218-0435#M12H A97L-0218-0458#M12H A97L-0218-0458#M12H A97L-0218-0458#M12H A97L-0218-0458#M12H A97L-0218+0458#M12H A97L-0218+0458#M12H A97L-0218+0458#M12H A97L-0218+0458#M12H A97L-0 Locking 12 12 1 1 4 4 1 16 16 1 1 4 4 1 1 LT263 Torque N-m (kgf-m) 318 (32.5) LT263 128 (13.1) Fig. 4.3 (f) Replacing J1-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L/100H/150U/220U) Note): Hanging jig for the left side and right are not identical. Namely, the screw hole position on the left hanging jig is different from those on the right hanging jig. So, note that the hanging jig for one side cannot be installed on the other side. posture that the end effector does not touch the gound when removing J2 base and upper unit 5L) /18 0iB 200 L) R pt 85 xce iB/1 °(E 000 -40 (R-2 ° 0 6 - -30°) -10° (Except R(R-2 000iB 2000iB/185L /185) L) 1 2 3 6 7 8 9 10 11 12 13 14 15 16 17 Specification R-2000iB/185L J2=-60° J3=-10° J5: The posture that the end effector does not touch the ground when removing J2 base and upper unit Eyebolt (M20) Position on the front side of robot. Eyebolt (M20) Hanging jig (A290-7329-X922) M12X50 (6pcs) Hanging jig (A290-7329-X923) M12X50 (6pcs) Fig. 4.3 (g) J1-axis reducer replacing posture (R-2000iB/165F/210F/185L/250F/210WE/125L/175L/100H/150U/220U) - 70 - 4.REPLACING PARTS B-82235EN/08 Plate J2 base Fig. 4.3 (h) Removing plate of J2 base left side (R-2000iB/165R/200R/100P) Posture Eyebolt (M20) R-4.REPLACING PARTS B-82235EN/08 Plate J2 base Fig. 4.3 (h) Removing plate of J2 base left side (R-2000iB/165R/200R/100P) Posture Eyebolt (M20) R-4.REPLACING PARTS B-82235EN/08 Plate J2 base Fig. 4.3 (h) Removing plate of J2 base left side (R-2000iB/165R/200R/100P) Posture Eyebolt (M20) R-4.REPLACING PARTS B-82235EN/08 Plate J2 base Fig. 4.3 (h) Removing plate of J2 base left side (R-2000iB/165R/200R/100P) Posture Eyebolt (M20) R-4.REPLACING PARTS B-82235EN/08 Plate J2 base Fig. 4.3 (h) Removing plate of J2 base left side (R-2000iB/165R/200R/100P) Posture Eyebolt (M20) R-4.REPLACING PARTS B-82235EN/08 Plate J2 base Fig. 4.3 (h) Removing plate of J2 base left side (R-2000iB/165R/200R/100P) Posture Eyebolt (M20) R-4.REPLACING PARTS B-82235EN/08 Plate J2 base Fig. 4.3 (h) Removing plate of J2 base left side (R-2000iB/165R/200R/100P) Posture Eyebolt (M20) R-4.REPLACING PARTS B-82235EN/08 Plate J2 base Fig. 4.3 (h) Removing plate of J2 base left side (R-2000iB/165R/200R/100P) Posture Eyebolt (M20) R-4.REPLACING PARTS B-82235EN/08 Plate J2 base Fig. 4.3 (h) Removing plate of J2 base left side (R-2000iB/165R/200R/100P) Posture Eyebolt (M20) R-4.REPLACING PARTS B-82235EN/08 Plate J2 base Fig. 4.3 (h) Removing plate of J2 base Fig. 4.3 (h) Removing plate of J2 base Fig. 4.3 (h) R-4.REPLACING PARTS B-82235EN/08 Plate J2 base Fig. 4.3 (h) R-4.REPLACING PARTS B-82235EN/08 Plate J2 base Fig. 4.3 (h) R-4.REPLACING PARTS B-82235EN/08 Plate J2 base Fig. 4.3 (h) R-4.REPLACING PARTS B-82235EN/08 Plate J2 base Fig. 4.3 (h) R-4.REPLACING PARTS B-82235EN/08 Plate J2 base Fig. 4.3 (h) R-4.REPLACING PARTS B-82235EN/08 Plate J2 base Fig. 4.3 (h) R-4.REPLACING PARTS B-82235EN/08 Plate J2 base Fig. 4.3 (h) R-4.REPLACING PARTS B 2000iB/165R,200R J2=-120° J3=40° J5: The posture that end effector does not touch the ground when removing J2 base and upper unit. R-2000iB/100P J2=-120° J3=41° J5: The posture that end effector does not touch the ground when removing J2 base and upper unit. R-2000iB/100P J2=-120° J3=41° J5: The posture that end effector does not touch the ground when removing J2 base and upper unit. R-2000iB/100P J2=-120° J3=41° J5: The posture that end effector does not touch the ground when removing J2 base and upper unit. R-2000iB/100P J2=-120° J3=41° J5: The posture that end effector does not touch the ground when removing J2 base and upper unit. R-2000iB/100P J2=-120° J3=41° J5: The posture that end effector does not touch the ground when removing J2 base and upper unit. R-2000iB/100P J2=-120° J3=41° J5: The posture that end effector does not touch the ground when removing J2 base and upper unit. R-2000iB/100P J2=-120° J3=41° J5: The posture that end effector does not touch the ground when removing J2 base and upper unit. R-2000iB/100P J2=-120° J3=41° J5: The posture that end effector does not touch the ground when removing J2 base and upper unit. R-2000iB/100P J2=-120° J3=41° J5: The posture that end effector does not touch the ground when removing J2 base and upper unit. R-2000iB/100P J2=-120° J3=41° J5: The posture that end effector does not touch the ground when removing J2 base and upper unit. R-2000iB/100P J2=-120° J3=41° J5: The posture that end effector does not touch the ground when removing J2 base and upper unit. R-2000iB/100P J2=-120° J3=41° J5: The posture that end effector does not touch the ground when removing J2 base and upper unit. R-2000iB/100P J2=-120° J3=41° J5: The posture that end effector does not touch the ground when removing J2 base and upper unit. R-2000iB/100P J2=-120° J3=41° J5: The posture that end effector does not touch the ground when removing J2 base and upper unit. R-2000iB/100P J2=-120° J3=41° J5: The posture that end effector does not touch the ground when removing J2 base and upper u M12X30 (4 pcs) Nut M20 Hanging jig (A290-7329-Y922) M12X30 (6 pcs) Nut (M20) Witness mark plate Fig. 4.3 (i) J1-axis reducer replacing posture (R-2000iB/165R/200R/100P) - 71 - 4.REPLACING PARTS B-82235EN/08 Posture R-2000iB/165R/200R/100P) - 71 - 4.REPLACING PARTS B-82235EN/08 Posture R-2000iB/170CF J2=-30° J3=-25° J5: The posture that end effector does not touch the ground when removing J2 base and upper unit. Eyebolt (M20) Hanging jig (A290-7329-X922) M12X50 (6 pcs) Hanging jig (A290-7329-Z922) M12X40 (4 pcs) Witness mark plate Fig. 4.3 (j) J1-axis reducer - 72 - 4.REPLACING PARTS B-82235EN/08 Insert two guide pins (A290-7329-X922) M12X40 (4 pcs) Witness mark plate Fig. 4.3 (j) J1-axis reducer - 72 - 4.REPLACING PARTS B-82235EN/08 Insert two guide pins (A290-7329-X922) M12X40 (4 pcs) Witness mark plate Fig. 4.3 (j) J1-axis reducer - 72 - 4.REPLACING PARTS B-82235EN/08 Insert two guide pins (A290-7329-X922) M12X40 (4 pcs) Witness mark plate Fig. 4.3 (j) J1-axis reducer - 72 - 4.REPLACING PARTS B-82235EN/08 Insert two guide pins (A290-7329-X922) M12X40 (4 pcs) Witness mark plate Fig. 4.3 (j) J1-axis reducer - 72 - 4.REPLACING PARTS B-82235EN/08 Insert two guide pins (A290-7329-X922) M12X40 (4 pcs) Witness mark plate Fig. 4.3 (j) J1-axis reducer - 72 - 4.REPLACING PARTS B-82235EN/08 Insert two guide pins (A290-7329-X922) M12X40 (4 pcs) Witness mark plate Fig. 4.3 (j) J1-axis reducer - 72 - 4.REPLACING PARTS B-82235EN/08 Insert two guide pins (A290-7329-X922) M12X40 (4 pcs) Witness mark plate Fig. 4.3 (j) J1-axis reducer - 72 - 4.REPLACING PARTS B-82235EN/08 Insert two guide pins (A290-7329-X922) M12X40 (4 pcs) Witness mark plate Fig. 4.3 (j) J1-axis reducer - 72 - 4.REPLACING PARTS B-82235EN/08 Insert two guide pins (A290-7329-X922) M12X40 (4 pcs) Witness mark plate Fig. 4.3 (j) J1-axis reducer - 72 - 4.REPLACING PARTS B-82235EN/08 Insert two guide pins (A290-7329-X922) M12X40 (4 pcs) Witness mark plate Fig. 4.3 (j) J1-axis reducer - 72 - 4.REPLACING PARTS B-82235EN/08 Insert two guide pins (A290-7329-X922) M12X40 (4 pcs) Witness mark plate Fig. 4.3 (j) J1-axis reducer - 72 - 4.REPLACING PARTS B-82235EN/08 Insert two guide pins (A290-7329-X922) M12X40 (4 pcs) Witness mark plate Fig. 4.3 (j) J1-axis reducer - 72 - 4.REPLACING PARTS B-82235EN/08 Insert two guide pins (A290-7329-X922) M12X40 (4 pcs) Witness mark plate Fig. 4.3 (j) J1-axis reducer - 72 - 4.REPLACING PARTS B-8235EN/08 Insert two guide pins (A290 into any diagonal pair on this circumference. Insert two guide pins (A290-7324-X923) into these holes on this circumference. In this time, into any diagonal pair on this circumference. In this time, into any diagonal pair on this circumference. In this time, into any diagonal pair on this circumference. Insert two guide pins (A290-7324-X923) into these holes on this circumference. In this time, into any diagonal pair on this circumference. Insert two guide pins (A290-7324-X923) into these holes on this circumference. In this time, into any diagonal pair on this circumference. Insert two guide pins (A290-7324-X923) into these holes on this circumference. Insert two guide pins (A290-7324-X923) into the diagonal pair on this circumference. Insert two guide pins (A290-7324-X923) into the diagonal pair on this circumference. Insert two guide pins (A290-7324-X923) into the diagonal pair on this circumference. Insert two guide pins (A290-7324-X923) into the diagonal pair on this circumference. Insert two guide pins (A290-7324-X923) into the diagonal pair on this circumference. Insert two guide pins (A290-7324-X923) into the diagonal pair on this circumference. Insert two guide pins (A290-7324-X923) into the diagonal pair on this circumference. Insert two guide pins (A290-7324-X923) into the diagonal pair on this circumference. Insert two guide pins (A290-7324-X923) into the diagonal pair on the diago match phase of reducer to J2 base. Insert the spring pin into this reamer bore. J2 base side Insertion positions of the guide pins and spring pin - 73 - 4.REPLACING PARTS B-82235EN/08 A Note) Take special care and check that there are no gaps of sealant to the J1-axis reducer - 74 - 4.REPLACING PARTS B-82235EN/08 Replacing J1-axis reducer (R-2000iB/165CF) Remove 1 2 3 4 5 6 7 8 9 10 11 12 13 14 Set dial gauges at J1-axis, and prepare for single axis mastering after replacement. Set the Quick Master Reference Position referring to Section 8.4 of the Operator's Manual. (All the axes are set to 0° before shipment.) Remove loads such as the hand and workpiece from the vrist. Place the robot in the posture for transportation. Turn off the connector panel, and remove the J1-axis motor as described above Remove the connector. Remove the solution cable between the controller panel. cable clamp in the J1 base, the connector panel on the side of J1 base, and the cable clamp of the J1 base so that the cable is released from the J1 unit when the robot body is hoisted. Separate J2 arm from J2-axis reducer referring to Section of replacing J2-axis reducer referring to Section of replacing J2-axis reducer (R-2000iB/165CF). Remove the J1 base mounting bolt (1) and washer (2) and hoist the robot body to separate it from the J1 unit while being careful not to damage the cable. Remove the table mounting bolt (3) and washer (4) and then remove the table (5). Remove the table (5). Remove the table mounting bolt (9), washer (10), and O-ring (11) and then remove the table mounting bolt (3) and washer (4) and then remove the table mounting bolt (9). pipe mounting bolt (16), washer (15), and O-ring (13) and then remove the pipe (14) from the reducer (12). Assembling 1 2 3 4 5 6 7 8 9 10 11 12 13 Polish the reducer (12), and secure the pipe with the pipe mounting bolt (16) and washer (15). Apply sealant (see Section 4.9, "SEALANT APPLICATION" and Fig. 4.3 (o)). Place the reducer with the reducer with the reducer mounting bolt (9) and washer (10). Install the table (5) and secure the table with the table installation bolt (3) and washer (4). At this time, make sure that the oil seal (6) is attached in the specified position. Place the robot with the J1 base mounting bolt (1) and washer (2). Attach J2 arm to J2-axis reducer. Perform forming of the cable and secure the clamp in the J1 base, and the J1 base, and the J1 base, and the J1 base clamp. Attach the connector to the connector cable between controller and the robot. Secure the motor as described above. Apply grease. (See section 2.3.) Perform quick mastering, then perform single axis mastering to J1-axis. - 75 - 4.REPLACING PARTS Parts name 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 BOLT WASHER BOLT WASHER TABLE OIL SEAL BEARING J1 GEAR 2 BOLT WASHER O-RING REDUCER O-RING REDUCER O-RING PIPE WASHER BOLT B-82235EN/08 Specifications A6-BA-12X85 A97L-0001-0823#M12H A6-BA-12X85 A97L-0001-0823#M12H A290-7321-X202 A98L-0040-0047#12515514 A97L-0001-0823#M12H A6-BA-12X85 A97L-0001-0823#M12H A6-BA-12X85 A97L-0001-0823#M12H A6-BA-12X85 A97L-0001-0823#M12H A290-7321-X202 A98L-0040-0047#12515514 A97L-0001-0823#M12H A6-BA-12X85 A97L-0001-0823#M12H A6 18X145 A97L-0001-0823#M18H A98L-0040-0041#281 A97L-0218-0237#320C-35 JB-OR1A-G135 A290-7321-X231 A97L-0001-0823#M6H A6-BA-6X16 Q'ty 16 16 15 15 1 1 1 9 9 1 1 1 1 4 4 Locking Torque N-m (kgf-m) LT263 128 (13.1) LT263 441 (45) Fig. 4.3 (n) Replacing J1-axis reducer (R-2000iB/165CF) - 76 - 4.REPLACING PARTS B-82235EN/08 CAUTION 注意 Apply LOCTITE 518 to the parts indicated by bold lines in beady form (with 太線部にシール剤(ロックタイト518)をビード状 (幅2mm以上)に切れ a width of 2 mm or more) without interruption. 目なく塗布してください。 Fig. 4.3 (o) Applying sealant to the J1-axis reducer (R-2000iB/165CF) - 77 - 4. REPLACING PARTS 4.4 B-82235EN/08 REPLACING THE J2-AXIS MOTOR (M2) AND REDUCER Replacing the J2-axis motor (M2) (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L/100 H/150U) Remove 1 2 Set dial gauges at the J2-axis, and prepare for single axis mastering after replacement. Place the robot in the posture shown in Fig. 4.4 (h) to (j) and hoist it using a sling. When the J2-axis is locked at other posture, fix the J2 arm may move, posing a serious danger to you (the arm may fall in the direction of gravity or rise, depending on the load condition and posture). Fasten the arm so that it does not move. 3 4 5 6 7 8 9 Turn off the controller power. Remove the motor cover when it is attached. (See Section REPLACING MOTOR COVERS) When a fan is not mounted, remove the Pulsecoder connector. Hold the cover to prevent it from turning.) When fan is mounted, remove the fan. (See Section 4.7 REPLACING THE FAN.) Remove the three connectors from the J2-axis motor (1) horizontally, while being careful not to damage the surface of the gear teeth. Remove the bolt (8), seal washer (7), and O-ring (9) and then remove the input gear (6). Assembling 1 2 3 4 5 6 7 8 9 Polish the flange surface of the J2-axis motor (1) horizontally while being careful not to damage the surfaces of both gears' teeth. Attach the four motor mounting bolts (4) and washers (5). Attach the motor cover (2). When a fan was mounted, mount the fan. (See Section 4.7 REPLACING THE FANS.) Attach the motor cover when it was attached. (See Section 4.10 REPLACING MOTOR COVERS) Apply grease to the J2-axis reducer. (See Section 2.3.) Perform single axis mastering to Section 8.6 of the Operator's Manual. Tip When you are sure in which direction the arm moves while removing the motor, the safety is improved if the adjustable mechanical stopper (option) is also used for fastening the J2 arm. Press the motor, loosen all the motor by hand. If a force acts on the motor to be turned strongly in one direction, check whether the arm is correctly fastened, without removing the bolts. - 78 - 4.REPLACING PARTS B-82235EN/08 9 8 7 6 1 5 4 2 3 For the R-2000iB/165F, 200R, 100P, 170CF, note that the motor connector is attached to the side of the motor. The replacement procedure is the same as that for the R-2000iB/165F or other models. Parts name 1 MOTOR 2 COVER 3 BOLT 4 BOLT 5 WASHER 6 INPUT GEAR 7 8 SEAL WASHER BOLT (NOTE) 9 O-RING Specifications Except 210WE A06B-0041-B605#S142 A290-7324-X101 Except 210WE A6-BA-8X16 SUS Except 210WE A6-BA-12X30 210WE A97L-0218-0432#12X30 Except 210WE A06B-0041-B605#S142 A290-7324-X101 Except 210WE A6-BA-8X16 SUS Except 210WE A06B-0041-B605#S142 A290-7324-X101 Except 210WE A6-BA-8X16 SUS Except 210WE A6-BA-12X30 210WE A97L-0218-0432#12X30 Except 210WE A6-BA-8X16 SUS Except 210WE A6-BA-12X30 210WE A97L-0218-0432#12X30 Except 210WE A06B-0041-B605#S142 A290-7324-X101 Except 210WE A6-BA-8X16 SUS Except 210WE A06B-0041-B605#S142 A290-7324-X101 Except 210WE A6-BA-8X16 SUS Except 210WE 210WE A97L-0001-0823#M12H 210WE A97L-0218-0802#250 165R A97L-0218-0802#252 185L/250F/200R/150U A97L-0218-0802#28 210F/100P/175L/210WE A97L-0218-0802#28 210F/100P/175L/210F/ 210WE JB-OR4D-G125 Q'ty Locking Torque N-m (kgf-m) LT243 15.7 (1.6) 1 1 1 4 4 1 1 1 NOTE) The bolt specification differs between the robots shipped in October 2006 and later and those shipped in Oct 2006 and earlier and the M6 x 70 bolt is used for the robots shipped in November 2006 and later. Fig. 4.4 (a) Replacing the motor (M2) for J2-axis (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L/100H/150U) - 79 - 4.REPLACING PARTS B-82235EN/08 ナット Nut クラブスクリュー Grub screw Stopper ストッパ A290-7329-X943 A290-7329-X94 Bolts ボルト M12X45 (3)(3) M12X45 Grub screw クラブスクリュー ナット Nut Bolts ボルト M12X45 M12X45 (3)(3) ストッパ Stopper A290-7329-X942 Fig. 4.4 (b) J2-axis fixing fixture Replacing the J2-axis after replacement. Place the robot in the posture shown in Fig. 4.4 (j) and hoist it using a sling. When the J2 arm with a fixture such as Fig. 4.4 (b). WARNING If you try to remove the J2-axis is locked at other posture, fix the J2 arm may move, posing a serious danger to you (the arm may fall in the direction of gravity, depending on the load condition and posture). Fasten the arm so that it does not move. 3 4 5 6 7 8 9 10 Turn off the controller power. Remove the fan. (See Section 4.7 REPLACING THE FANS.) Remove the Pulsecoder connector cover (2). (The cover turns together with the bolts, possibly causing damage to the connector. Hold the cover to prevent it from turning.) Remove the four motor mounting bolts (4) and washers (5). Pull out the J2-axis motor (1) horizontally, while being careful not to damage the surface of the gear teeth. Remove the bolt (9), seal washer (8), and O-ring (10) and then remove the input gear (7) with bolt (9) and seal washer (8). Place the new O-ring (10) and then remove the input gear (7) with bolt (9) and seal washer (8). (10) in the specified position, and mount the J2-axis motor (1). Attach the three motor mounting seal bolts (4) and washers (5). Attach the three connectors to the J2-axis motor (1). Attach the three motor mounting seal bolts (4) and washers (5). Section 4.7 REPLACING THE FANS.) Attach the motor cover when it was attached. (See Section 4.10 REPLACING MOTOR COVERS) Apply grease to the J2-axis reducer. (See Section 2.3.) Perform single axis mastering referring to Section 4.10 REPLACING MOTOR COVERS) Apply grease to the J2-axis reducer. (See Section 4.10 REPLACING MOTOR COVERS) Apply grease to the J2-axis reducer. (See Section 4.10 REPLACING MOTOR COVERS) Apply grease to the J2-axis reducer. (See Section 4.10 REPLACING MOTOR COVERS) Apply grease to the J2-axis reducer. (See Section 4.10 REPLACING MOTOR COVERS) Apply grease to the J2-axis reducer. 5 6 7 8 9 10 MOTOR COVER BOLT BOLT WASHER DRAW NUT INPUT GEAR SEAL WASHER BOLT O-RING Specifications Q'ty Locking A06B-0272-B605#S000 1 A290-7324-X101 1 A6-BA-8X65 1 LT243 JB-OR1A-G125 1 Fig. 4.4 (c) Replacing the motor (M2) for J2-axis (R-2000iB/220U) - 81 - Torque N-m (kgf-m) 27.5 (2.8) 4.REPLACING PARTS B-82235EN/08 Replacing the J2-axis, and prepare for single axis mastering after replacement. Place the robot in the posture shown in Fig. 4.4 (n) and hoist it using a sling. When the J2-axis is locked at other posture, fix the J2 arm with a fixture such as Fig. 4.4 (e). WARNING If you try to remove the J2-axis motor without fastening the J2 arm may move, posing a serious danger to you (the arm may fall in the direction of gravity, depending on the load condition and posture). Fasten the arm so that it does not move. 3 4 5 6 7 Turn off the controller power. Remove the three connectors of the motor (1) horizontally while being careful not to damage the surface of the gear teeth. Remove the nut (7) and washer (6) and then remove the input gear (5), draw bolt (4), and O-ring (8). Assembling 1 2 3 4 5 6 7 8 Polish the flange surface of the motor (1) using an oilstone. Attach the input gear (5) and nut (7). Place the new O-ring (8) in the specified position, and mount the motor (1) horizontally while being careful not to damage. the surface of the gear teeth. Attach the four motor mounting seal bolts (2) and washers (3). Attach the three connectors to the motor (1). Apply grease to the J2-axis reducer. (See Section 2.3.) Perform single axis mastering the three connectors to the motor (2). motor, the safety is improved if the adjustable mechanical stopper (option) is also used for fastening the J2 arm. Press the arm against the motor. Before removing the motor, loosen all the four mounting bolts and try to turn the motor by hand. If a force acts on the motor to cause the motor to be turned strongly in one direction, check whether the arm is correctly fastened, without removing the bolts. - 82 - 4.REPLACING PARTS B-82235EN/08 Parts name 1 2 3 4 5 6 7 8 MOTOR SEAL BOLT WASHER DRAW BOLT INPUT GEAR WASHER NUT O-RING Specifications A06B-0267-B605#S000 A97L-0118-0760#M12X30 A97L-0001-0823#M12H Included in A97L-0218-0245#210 Included in A97L-02 M16X55 (6) M12X55 (6) Stopper ストッパ A290-7329-Z944 A290-7329-Z944 A290-7329-Z944 ボルト M12X50 (6) チット Nut ナット Nut ナット Nut ナット Nut ナット Nut テット Nut Full A290-7329-X944 A290-- 4.REPLACING PARTS B-82235EN/08 Replacing J2-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L /100H/150U/220U) Parts name Guide pin Common tool for replacing the J2-axis reducer Specifications A290-7324-X921 Q'ty 2 Remove 1 2 3 4 5 6 7 8 9 Set dial gauges at the J2-axis, and prepare for single axis mastering after replacement. Record the Quick Master Reference Position referring to Section 8.4, 8.5 of the Operator's Manual. (It is set in 0° for all axes when robot is shipped.) Place the arm in the posture shown in Fig. 4.4 (h), (i) and (j). Turn off the controller power. Remove the motor cover when it is attached. (See Section REPLACING MOTOR COVERS) Detach all of the cables connected to the J3 through J6-axis motors and option cables, and pull out the cables to the outside of the J2 base. Remove the J2 base. axis motor according to the procedure described in the previous item. WARNING If the balancer, can cause the J2 arm to move extensively, resulting in a very dangerous situation. Before starting to remove the J2-axis motor, be sure to remove the J2 arm by using a crane. 10 11 12 Remove the J2 arm mounting bolts (1) and washers (2), then remove the J2 arm by using a crane. 10 11 12 Remove the sling. Then, remove the J2 arm by using a crane. remove the reducer (6) with guide pin, and remove the O-ring (7). In case of 210WE, remove the ring (8). Assembling 1 2 3 In case of 210WE, attach the reducer mounting surface of the J2 base with an oilstone. Place the new O-ring (7) in the specified position and install the new reducer (6) with the bolt (4) and washer (5) via the guide pins as shown in Fig. 4.4 (l). 4 Place the new O-ring (3) in the groove of the reducer. When it is difficult to fix the O-ring, apply a small amount of grease and then attach the O-ring to the groove. 5 By using a guide pin, fasten the J2 arm to the reducer (6) with the bolts (1) and washers (2). At this time be sure that the O-ring (3) is not removed. 6 Mount the J2-axis motor according to the procedure described earlier. 7 Mount the balancer.) 8 Attach the cables for connection to the J3 through J6-axis motors and the option cables. 9 Attach the motor cover when it was attached. (See Section REPLACING MOTOR COVERS) 10 Apply grease to the J2-axis reducer. (See Section 2.3.) 11 Perform quick mastering to J2-axis referring to Section 8.4 to 8.6 of the Operator's Manual. - 84 - 4.REPLACING PARTS B-82235EN/08 NOTE When the influence of the damaged pieces generated from broken reducer is concerned about, exchange input gear of J2-axis. 7 6 4 5 8 2 1 3 Parts name 1 BOLT 2 WASHER 3 O-RING 8 RING Specifications Except 210WE 210W 210WE 210WE 165F/170CF /125L 210F/100P /175L 185L/250F 165R 200R/150U 210WE 100H 220U Except 210WE 200WE 210WE 210 A6-BA-12X75 A97L-0218-0432#12X60 A97L-0218-0383#450N-236 A97L-0218-0383#450N-236 A97L-0218-0383#450N-290 A97L-0218-0383#450N-290 A97L-0218-0383#450N-290 A97L-0218-0383#450N-290 A97L-0218-0383#450N-236 A A290-7329-X897 1 1 1 Fig. 4.4 (f) Replacing J2-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L/100H/150U/220U) - 85 - 4.REPLACING PARTS B-82235EN/08 Ring リング(9) (9) Fig. 4.4 (g) Installation position of the ring (R-2000iB/210WE) Hang the J3-axis reducer in a slingb (one sling) Hang the J3-axis reducer in a sling (one sling) (This sling is not need in case of replacing reducer) Use the M10 threaded holes and the eye bolts (two slings) Use the M10 threaded holes and the eye bolts (t 2000iB/165F/210F/185L/250F/210WE/125L/175L/100H) - 86 - 4.REPLACING PARTS B-82235EN/08 Hang the J3-axis reducer in a sling (one sling) (This sling is not need in case of replacing reducer) Use the M10 threaded holes and the eye bolts (two slings) Use the M10 threaded holes (two slings) Use the M10 thr (one sling) (This sling is not need in case of replacing reducer) Fig. 4.4 (i) J2-axis motor and reducer replacing posture (R-2000iB/165R/200R/100P) Wind sling around the wrist unit (one sling) Fig. 4.4 (j) J2-axis motor and reducer replacing posture (R-2000iB/165R/200R/100P) Wind sling around the wrist unit (one sling) Fig. 4.4 (j) J2-axis motor and reducer replacing posture (R-2000iB/150U/220U) - 87 - 4.REPLACING PARTS B-82235EN/08 Use the M10 threaded holes and the eyebolts (one sling) Hang the wrist in a sling (one sling) Fig. 4.4 (k) J2-axis motor and reducer replacing posture (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF) J2-axis reducer Guide pin (M12) J2 arm Fig. 4.4 (l) Guide pin (M12) J2 arm Fig. 4.4 (l) Guide pin (M12) J2 arm Fig. 4.4 (l) Guide pin (M12) J2-axis reducer Guide pin (M12) J2 arm Fig. 4.4 (l) Guide pin (M12) J2 arm Fig. 4. 4.REPLACING PARTS B-82235EN/08 Replacing J2-axis reducer (R-2000iB/165CF) Name Specifications Q'ty Guide pin Guide p robot in the posture shown in Fig. 4.4 (n) and hoist it using a sling. Turn off the controller power. Remove the J2 arm mounting bolts (3) and (5) and then remove the J2 arm (7) via the guide pins as shown in Fig. 4.4 (o). At this time, apply a sufficient tension to the sling. Remove the J2 arm (7) via the guide pins as shown in Fig. 4.4 (o). the reducer mounting bolt (8) and the washer (9), remove the reducer (10) via the guide pins as shown in Fig. 4.4 (o). Fix the motor (1) as remove the O-ring (11). Assembling 1 2 3 4 Place the new O-ring (11) in the specified position and install the new reducer (10) with the bolt (8) and washer (9) via the guide pins as shown in Fig. 4.4 (o). Fix the motor (1) as described above. Apply sealant to the reducer (see Section 4.9, "SEALANT APPLICATION" and Fig. 4.4 (p)). Attach the new O-ring (13) and ring (12) to the J2 arm. CAUTION Do not apply grease to the O-ring, apply a small amount of sealant to the O-ring and then attach it to the O-ring groove of the J2 arm to the reducer (10) via the guide pins with J2 arm mounting bolts (3) and (5) and washers (4) and (6). At this time, make sure that the O-ring (13) and ring (12) are placed in the specified positions. CAUTION The J2 arm needs to be intimately attached in one operation so that the seal surface that was once brought into contact with the corresponding member does not separate from it, the O-ring may fall off. When the seal surface that was once brought into contact with the corresponding member and the attachment of the O-ring again and then perform reassembly. 6 7 Apply grease to the J2-axis reducer. (See Section 2.3.) Perform single axis mastering referring to Section 2.3.) Perform single axis mastering referring to Section 2.3.) 4.REPLACING PARTS Parts name 1 2 3 4 5 6 7 8 9 10 11 12 13 MOTOR O-RING BOLT WASHER BOLT WASHER I2 ARM BOLT WASHER REDUCER O-RING B-82235EN/08 Specifications A06B-0267-B605#S000 JB-OR1A-G125 A6-BA-16X55 A97L-0001-0823#M16H A6-BA-12X45 A97L-0001-0823#M12H A290-7321-X314 A6-BA-12X45 A97L-0001-0823#M12H A97L-0218-0238#450E-210 JB-OR1A-G300 A290-7321-X316 A98L-0001-0347#S265 Q'ty 1 1 6 6 21 21 1 24 24 1 1 1 1 Locking Torque N-m (kgf-m) LT263 128 (13.1) Fig. 4.4 (m) Replacing J2-axis reducer (R-2000iB/165CF) - 90 - 4.REPLACING PARTS B-82235EN/08 Fig. 4.4 (n) Posture during replacement of the J2-axis motor (M2) and the reducer (R-2000iB/165CF) J2 arm Guide pin (M12) Guide pin J2-axis reducer (R-2000iB/165CF) 4.5 REPLACING THE J3-AXIS MOTOR (M3), GEARBOX, AND REDUCER Replacing J3-axis motor (M3) (R-2000iB/165F/210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H /150U/220U) Remove 1 2 Set dial gauges at the J3-axis, and prepare for single axis mastering after replacement. Ensure that the robot sture shown in Fig. 4.5 (i) to (k), and hang the robot with a sling. When the J3-axis is locked at other posture, fix the J2 arm without fastening the J3 arm first, the J3 arm may move, posing a serious danger to you. Fasten the arm so that 3 4 5 6 7 Turn off the controller power. Remove the fan. . (See Section 4.7 REPLACING THE FAN.) Detach the three connectors from the J3-axis motor (1). Remove the four motor mounting bolts (2) and washers (3). NOTE To remove and install the J3-axis motor, an M12 T-shaped hexagonal wrench not shorter than 250 mm is require. 8 9 Pull out the J3-axis motor (1) horizontally, while being careful not to damage the surface of the gear teeth. Remove the bolt (6) and washer (5), then dismount the input gear (4). - 92 - 4. REPLACING PARTS B-82235EN/08 Assembling 1 2 3 4 5 6 7 8 9 Polish the flange surface of the J3-axis motor (1) using an oilstone. Mount and fasten the input gear (4) with bolt (6) and washers' teeth. Attach the four motor mounting bolts (2) and washers' teeth. (3). Attach the three cable connectors to the J3-axis motor (1). When fan was mounted, mount the fan. (See Section 4.7 REPLACING THE FAN.) Attach the motor cover when it was attached. (See Section 8.6 of the Operator's Manual. Tip The safety is improved if the adjustable mechanical stopper (option) is also used for fastening the J3 arm. Press the arm against the mounted stopper by jogging the arm, and fine-tune the J3-axis angle so that no torque is applied to the motor. Before removing the motor, loosen all the four mounting bolts and try to turn the motor by hand. If a force acts on the motor to cause the motor to be turned strongly in one direction, check whether the arm is correctly fastened, without removing the bolts. - 93 - 4.REPLACING PARTS B-82235EN/08 7 1 6 5 4 3 2 Parts name 1 MOTOR 2 BOLT 3 WASHER 4 INPUT GEAR 5 6 SEAL WASHER BOLT (*1) 7 O-RING *1 Specifications Except A06B-0041-B605#S042 210WE 210WE A06B-0041-B605#S142 Except A6-BA-12X30 210WE 210WE A97L-0218-0432#12X30 Except A97L-0218-0432#12X30 3-0803#183 (Appended to INPUT GEAR) (Appended to INPUT GEAR) Except JB-OR1A-G125 210WE 210WE JB-OR4D-G125 Q'ty Locking Torque N-m (kgf-m) LT243 15.7 (1.6) 1 4 4 1 1 1 The bolt specification differs between the robots shipped in November 2006 and later and those shipped in October 2006 and earlier because the shape of the input gear was changed. Note that the M6 65 bolt is used for the robots shipped in October 2006 and earlier and the M6 70 bolt is used for the robots shipped in November 2006 and later. Fig. 4.5 (a) Replacing J3-axis motor (M3) (R-2000iB/165F/210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H/150U/220U) - 94 - 4.REPLACING PARTS B-82235EN/08 Bolts ボルト M12X50 M12X50 (3) (3) ボルト Bolts M12X50 (3) M12X50 (3) Stopper ストッパ A290-7329-X943 A290-7329-X943 Nut ナット Stopper ストッパ A290-7329-X943 Nut ナット Stopper ストッパ A290-7329-X943 Nut ナット Grub screw クラブスクリュー Fig. 4.5 (b) J3-axis fixing fixture - 95 - 4.REPLACING PARTS B-82235EN/08 Replacing J3-axis motor (M3) (R-2000iB/170CF) Remove 1 2 Set dial gauges at the J3-axis, and prepare for single axis mastering after replacement. Ensure that the robot with a sling. When the J3-axis is locked at other posture, fix the J2 arm with a fixture such as Fig. 4.5 (b). WARNING If you try to remove the J3-axis motor without fastening the J3 arm first, the J3 arm may move, posing a serious danger to you. Fasten the arm so that it does not move. 3 4 5 6 7 8 9 10 11 Turn off the controller power. Remove the motor cover when it is attached. (See Section REPLACING MOTOR COVERS) Remove the bolt (3) and then remove the Pulsecoder connector cover (4). (The cover turns together with the bolts, possibly causing damage to the connector. Hold the cover to prevent it from turning.) Remove the bolts (7) and washer (8). Pull out the J3-axis motor (1) and gearbox (2) horizontally. while being careful not to damage the surface of the gear teeth. Then, remove the O-ring (9). Remove the bolt (10), washer (11), and O-ring (12) from the shaft of the motor (1). Assembling 1 2 3 4 5 6 7 8 9 10 11 Polish the flange surface of the J3-axis motor (1) using an oilstone. Mount the bolt (12), then mount it to the shaft of the motor (1). Nount the bolt (12), then mount it to the shaft of the motor (1) and new O-ring (9) in the specified position, and mount the J3-axis motor (1) horizontally while being careful not to damage the surface of the gear teeth are not in engagement, rotate the J3 arm so that the teeth are in phase. Mount the motor (1) with the bolt (5). Attach the three cable connectors to the J3-axis motor (1). Mount the Pulsecoder connector cover (4) with the bolt (3). Attach the motor cover when it was attached. (See Section REPLACING MOTOR COVERS) Apply grease to the J3-axis reducer. (See Section 2.3.) Perform single axis mastering referring to Section 8.6 of the Operator's Manual. Tip The safety is improved if the adjustable mechanical stopper (option) is also used for fastening the J3-axis reducer. arm. Press the arm against the mounted stopper by jogging the arm, and fine-tune the J3-axis angle so that no torque is applied to the motor. Before removing the gearbox by hand. If a force acts on the gearbox by hand. If a force acts on the gearbox by hand the six mounting bolts and try to turn the gearbox by hand. If a force acts on the gearbox by hand. If a force acts on the gearbox by hand the six mounting bolts and try to turn the gearbox by hand. is correctly fastened, without removing the bolts. - 96 - 4.REPLACING PARTS B-82235EN/08 7 8 9 2 6 5 1 3 4 10 11 15 12 13 14 2 1 Parts name 1 2 3 4 5 6 7 8 9 10 11 12 13 14 2 1 Parts name 1 2 3 4 5 6 7 8 9 10 11 12 13 14 2 1 Parts name 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 Specifications MOTOR J3 GEARBOX ASSY BOLT COVER BOLT VASHER INPUT SPLINE SEAL WASHER BOLT O-RING A06B-0041-2000iB/170CF) - 97 - Torque N-m (kgf-m) 15.7 (1.6) 4.REPLACING PARTS B-82235EN/08 Replacing J3-axis motor (M3) (R-2000iB/165CF) Remove 1 2 Set dial gauges at the J3-axis, and prepare for single axis mastering after replacement. Ensure that the robot assumes the posture shown in Fig. 4.5 (o). When the J3-axis is locked at other posture, fix the J2 arm with a fixture such as Fig. 4.5 (e). WARNING If you try to remove the J3-axis motor without fastening the J3 arm first, the J3 arm first, the J3 arm may move, posing a serious danger to you. Fasten the arm so that it does not move. 3 4 5 6 7 Turn off the controller power. Remove the three connectors of the motor (1). Remove the four motor mounting seal bolts (2) and washers (3). Pull out the motor (1) horizontally while being careful not to damage the surface of the gear teeth. Remove the input gear (5), draw bolt (4), and O-ring (8). Assembling 1 2 3 4 5 6 7 8 Polish the flange surface of the motor (1) using an oilstone. Attach the draw bolt (4). Attach the draw bolt (4). input gear (5) and secure it with the washer (6) and nut (7). After attaching the new O-ring (8), mount the motor (1) horizontally while being careful not to damage the surface of the gear teeth. Attach the four motor mounting seal bolts (2) and washers (3). Attach the three connectors to the motor (1). Apply grease. (see Section 2.3.) Perform single axis mastering referring to Section 8.6 of the Operator's Manual. NOTE For the attachment of the J3-aixs motor (1), an M12T type hexagon wrench with a length of 370 mm or more is required. Tip The safety is improved if the stopper (option) for changing the operating range is also used for fastening the J3 arm. Press the arm against the mounted stopper by jogging the arm, and fine-tune the J3-axis angle so that no torque is applied to the motor. Before removing the motor to cause the motor to cause the motor to be turned strongly in one direction, check whether the arm is correctly fastened, without removing the motor to cause the motor. bolts. - 98 - 4.REPLACING PARTS B-82235EN/08 Parts name 1 2 3 4 5 6 7 8 Specifications MOTOR SEAL BOLT WASHER DRAW BOLT INPUT GEAR WASHER NUT O-RING Q'ty A06B-0267-B605#S000 A97L-0218-0227#190 Included in A97L-0218-02 Included in A97L-0218-0227#190 JB-OR1A-G125 1 4 4 1 1 1 1 1 Locking Torque N-m (kgf-m) LT243 118 (12) LT243 26.5 (2.7) Fig. 4.5 (d) Replacing the J3-axis motor (M3) (R-2000iB/165CF) Nut ナット Grub screw クラブスクリュー Stopper ストッパ A290-7329-X945 A290-7329-X945 Bolts ボルト M12X40 M12X40(3) (3) Nut ナット Grub screw クラブスクリュー リュー Stopper ストッパ A290-7329-X945 A290-7329-X945 Bolts ボルト M12X40 M12X40 (3) (3) Fig. 4.5 (e) J3-axis fixing fixture - 99 - 4.REPLACING PARTS B-82235EN/08 Replacing the J3-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L /100H/150U/220U) Parts name Guide pin Common tool for replacing the J3-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L /100H/150U/220U) Parts name Guide pin Common tool for replacing the J3-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L /100H/150U/220U) Parts name Guide pin Common tool for replacing the J3-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L /100H/150U/220U) Parts name Guide pin Common tool for replacing the J3-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L /100H/150U/220U) Parts name Guide pin Common tool for replacing the J3-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L /100H/150U/220U) Parts name Guide pin Common tool for replacing the J3-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L /100H/150U/220U) Parts name Guide pin Common tool for replacing the J3-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L /100H/150U/220U) Parts name Guide pin Common tool for replacing the J3-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L /100H/150U/220U) Parts name Guide pin Common tool for replacing the J3-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L /100H/150U/220U) Parts name Guide pin Common tool for replacing the J3-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L /100H/150U/220U) Parts name Guide pin Common tool for replacing the J3-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L /100H/150U/220U) Parts name Guide pin Common tool for replacing the J3-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF J3-axis reducer Specifications A290-7324-X921 Q'ty 2 Remove 1 2 3 4 5 6 7 8 9 10 11 Set dial gauges at the J3-axis, and prepare for single axis mastering after replacement. Record the Quick Master Reference Position referring to Section 8.4 and 8.5 of the Operator's Manual. (It is set in 0° for all axes when robot is shipped.) Place the reducer in the location of Fig. 4.5 (i) to (l), and hoist it using a sling. Turn off the controller power. Remove the motor cover when it is attached. (See Section 4.7 REPLACING THE FAN.) Detach the cables leading to the J3 to J6-axis motors, and all option cables, then pull out them from the J2 arm. Remove the J3 unit by using a guide pin as shown in Fig. 4.5 (m). At this time, apply a sufficient tension to the sling. Remove the J3 and washer (4), then dismount the reducer (6) with using the guide pin. In case of 210WE, remove the ring (8) referring to Fig. 4.5 (h). NOTE When installing the J3 axis reducer, attach an M12 hexagonal socket (with a tip not shorter than 70 mm) to a torque wrench, and tighten the bolt. Assembling 1 2 3 4 5 6 7 8 9 In case of 210WE, attach the ring (8) referring to Fig. 4.5 (h). 4.5 (h). Place the new O-ring (7) in the specified position and install the new reducer. When it is difficult to fix the O-ring, apply a small amount of grease and then attach the O-ring to the groove. Fix J3 unit to the J2 arm with the bolt (1) and washer (2) via the guide pins (see Fig. 4.5 (m)). Attach the J3-axis motors. Attach the motor cover when it was attached. (See Section REPLACING MOTOR COVERS) Apply grease. (See Section 2.3.). Perform quick mastering, then perform single axis mastering to J3-axis referring to Section 8.4 to 8.6 of the Operator's Manual. NOTE When the influence of the damaged pieces generated from broken reducer is concerned about, exchange input gear of J3-axis. - 100 - 4.REPLACING PARTS B-82235EN/08 7 6 4 3 8 1 2 5 (R-2000iB/165F/165R/100P/125L/100H/150U) Parts name 1 2 3 4 5 BOLT WASHER BOLT WASHER O-RING 6 REDUCER 7 O-RING 5 Pecifications A6-BA-12X50 A97L-0001-0823#M12H JB-OR1A-G170 Except 100H A97L-0218-0384#320N-183 A98L-0040-0041#272 Q'ty Locking 2-0001-0823#M12H JB-OR1A-G170 Except 100H A97L-0218-0384#320N-235 100H A97L-0218-0384#320N-23 24 18 18 1 LT263 Torque N-m (kgf-m) 128 (13.1) LT263 128 (13.1) 1 1 (R-2000iB/210F/185L/250F/200R/175L/220U) Parts name 1 2 3 4 5 BOLT WASHER BOLT WASHER BOLT WASHER BOLT WASHER 0-RING 6 REDUCER 7 O-RING 5 Pecifications A6-BA-12X50 A97L-0001-0823#M12H A6-BA-12X50 A97L-0001-0823#M12H A6-BA-12X50 A97L-0218-0383#450N-270 185L/250F 185L/250F A97L-0218-0383#450N-297 JB-OR1A-G280 Q'ty Locking 30 30 24 24 1 LT263 Torque N-m (kgf-m) 128 (13.1) 1 1 (R-2000iB/210WE) Parts name 1 2 3 4 5 6 7 8 BOLT WASHER O-RING REDUCER O-RING REDUCER O-RING RING J3 Specification A97L-0218-0432#12X50 A97L-0218-0435#M12H A97L-0218 0432#12X60 A97L-0218-0435#M12H JB-OR4D-G190 A97L-0218-0929#450N-270 JB-OR4D-G280 A290-7329-X898 Q'ty Locking 30 30 24 24 1 1 1 1 LT263 Torque N-m (kgf-m) 128 (13.1) Fig. 4.5 (f) Replacing J3-axis reducer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H/150U/220U) - 101 0823#M12H JB-OR1A-G170 A97L-0218-0820#320N-144 A98L-0040-0041#272 Locking Torque N-m (kgf-m) LT263 128 (13.1) LT263 128 (13.1) 1 1 20 20 18 18 1 1 1 Fig. 4.5 (g) Replacing J3-axis reducer (R-2000iB/170CF) Ring (10) リング (10) J3-axis reducer J3軸減速機 Fig. 4.5 (h) Installation position of the ring (R-2000iB/210WE) - 102 · 82235EN/08 Wind sling around the wrist unit (one sling) Fig. 4.5 (k) J3-axis motor and reducer replacing posture (R-2000iB/150U/220U) Use the M10 threaded holes and the eyebolts (one sling) Fig. 4.5 (k) J3-axis motor and reducer replacing posture (R-2000iB/170CF) - 104 - 4.REPLACING PARTS B-82235EN/08 Guide pin (M12) Guide pin (M12) J3-axis reducer J2 arm Fig. 4.5 (m) Using of guide pin Replacing the J3-axis reducer (R-2000iB/165CF) 1 2 3 4 5 6 7 8 Parts name Specifications Q'ty Guide pin Guide pin A290-7324-X921 A290-7324-X923 1 1 Set dial gauges at the J3-axis, and prepare for single axis mastering after replacement. Record the Quick Master Reference Position referring to Section 8.4 of the Operator's Manual. (It is set in 0° for all axes when robot is shipped.) Place the reducer in the location of Fig. 4.5 (o), and hoist it using a sling. Turn off the controller power. Detach the cables leading to the J3 to J6-axis mastering to Section 8.4 of the Operator's Manual. (It is set in 0° for all axes when robot is shipped.) Place the reducer in the location of Fig. 4.5 (o), and hoist it using a sling. motors, and all option cables, then pull out them from the J2 arm. Remove the J3 unit by using a guide pin as shown in Fig. 4.5 (p). At this time, apply a sufficient tension to the sling. (See Fig.4.5 (o).) Remove the reducer mounting bolt (10) and washer (11), then dismount the reducer (9) with using the guide pin, then remove the O-ring (7), (12). NOTE When installing the J3 axis reducer, attach an M12 hexagonal socket (with a tip not shorter than 70 mm) to a torque wrench, and tighten the bolt. - 105 - 4.REPLACING PARTS B-82235EN/08 Assembling 1 2 3 By using a guide pin as shown in Fig. 4.5 (p), install a new reducer (9) with the bolt (10) and washer (11). At this time, check that the O-ring (12) is installed in position. Apply grease to the O-ring (7). Otherwise, hardening of sealant is prevented, causing a grease leak. When it is difficult to fix the O-ring and then attach it to the J2 arm. 4 Fix the J3 unit to the J2 arm. (13) with the bolts (3) and (5) and the washers (4) and (6) via the guide pins. At this time, make sure that the O-ring (7) and ring (8) are placed in the specified positions. CAUTIOIN The J3 arm needs to be intimately attached in one operation so that the seal surface that was once brought into contact with the corresponding member separates from it, the O-ring may fall off. When the seal surface incorrectly separates from it, check the state of sealant on the seal surface and then perform reassembly. 5 6 7 8 Attach the J3-axis motor (1) and new O-ring (2) in as described above. Attach the cables and option cables to be connected to the J3- to J6-axis motors. Supply grease to the J3-axis reducer (See Section 2.3.). Perform quick mastering, then perform single axis mastering to J1-axis referring to J1-axis referring to J1-axis referring to Section 8.4 and 8.6 of the Operator's Manual. NOTE When the influence of the damaged pieces generated from broken reducer is concerned about, exchange input gear of J3-axis. - 106 4.REPLACING PARTS B-82235EN/08 Parts name 1 2 3 4 5 6 7 8 9 10 11 12 13 MOTOR O-RING BOLT WASHER OOI-0823#M16H A98L-0001-0823#M16H A98L-0001-084 A290-7321-X317 A97L-0218-0239#320E-190 A6-BA-12X50 A97L-0001-0823#M12H JB-OR1A-G270 A290-7321-X314 1 1 18 18 6 6 1 1 1 16 16 1 1 Locking Torque N-m (kgf-m) LT263 73.5 (7.5) LT263 128 (13.1) Fig. 4.5 (o) J3-axis reducer (R-2000iB/165CF) - 107 - 4.REPLACING PARTS B-82235EN/08 Fig. 4.5 (o) J3-axis reducer replacing posture (R-2000iB/165CF) Guide pin (M12) J3 unit J3-axis reducer Fig. 4.5 (p) Using of guide pin (R-2000iB/165CF) - 108 - 4. REPLACING PARTS B-82235EN/08 A A A A Note) Take special care and check that 注: 特にA部は切れ目なく塗布すること there are no gaps of sealant around part A. LOCTITE 518 applying area ロックタイト 518塗布範囲 Fig. 4.5 (q) Applying sealant to the J3-axis reducer (R-2000iB/165CF) - 109 - A 4.REPLACING PARTS 4.6 B-82235EN/08 REPLACING THE WRIST AXIS MOTORS (M4, M5, AND M6), WRIST UNIT, AND J4 AXIS REDUCER CAUTION WHEN PERFORMING LOAD ESTIMATION AFTER PARTS REPLACEMENT If wrist axes (J5,J6-axis) motors or reducers are replaced, estimation accuracy may go down. Perform the calibration for load estimation before performing load estimation. Refer to below. Section 9.15 "LOAD ESTIMATION" in R-30iA Controller Spot tool+ OPERATOR'S MANUAL (B-83124EN-1). Section 9.15 "LOAD ESTIMATION" in R-30iA Controller Handlince and the calibration for load estimation before performing load estimation. Refer to below. tool OPERATOR'S MANUAL (B-83124EN-2). Section 9.15 "LOAD ESTIMATION" in R-30iB/R-30iB Mate Controller Dispense tool OPERATOR'S MANUAL (B-83284EN-2). Replacing the wrist axis motors (M4, M5, and M6) (R-30iB/R-30iB Mate Controller Dispense tool OPERATOR'S MANUAL (B-83284EN-2). Replacing the wrist axis motors (M4, M5, and M6) (R-30iB/R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L /100H/150U/220U) Remove 1 2 3 4 5 6 7 8 9 10 11 Set dial gauges at the J4 to J6-axis, and prepare for single axis mastering after replacement. Place the wrist in a posture in which no load is applied to the wrist axis. Turn off the controller power. In case of motor cover is attached, remove it. (See Section REPLACING MOTOR COVERS) R-2000iB/170CF, remove the J3 connector panel. (See Chapter 5.) By Fig. 4.6 (c), confirm the motor (1). In case of 210WE(B256), remove the tube connected to the motor. Remove the three motor mounting bolts (2) and washers (3). Pull out the motor (1), while being careful not to damage the surface of the gear (4) to the motor (5), and dismount the gear (4) to the motor (5), and nut (6), washer (5), and nut (6), Place the new O-ring (7) in the specified position, and mount the motor (1) while being careful not to damage the surface of the gear teeth. At this time, make sure that the O-ring (7) is attached in the specified position. Also note the direction (connector phase) in which the motor (1) is mounted. Attach the three motor mounting bolts (2) and washer (3). Attach the three cable connectors to the motor (1). In case of 210WE(B256), connect the tube to the motor cover when it was attached. (See Section 2.3.) Perform single axis mastering for J4/J5/J6-axes referring to Section 8.6 of the Operator's Manual. NOTE 1 When tightening the nut (6), hold the gear (4) with a 30x32mm or 32x36mm spanner (Thickness is 14mm or less). 2 To install a motor, an M8 T-shaped hexagonal wrench not shorter than 250mm is required. - 110 - 4.REPLACING PARTS B-82235EN/08 7 7 6 5 4 1 7 6 5 3 2 7 6 J5 4 1 J6 3 2 5 4 J4 1 3 2 Parts name 1 MOTOR 2 BOLT WASHER GEAR J41 (J4-axis gear) 4 GEAR J51 (J5-axis gear) 5 WASHER 6 NUT 7 O-RING Specifications Except 170C/210WE A06B-0238-B605#S100 210WE(B255) A06B-0238-B605#S100 200 A06B-0238-B605#S100 A06B-0238-B605#S 210WE A97L-0001-0823#M8H 210WE A97L-0218-0435#M8H 165F/210F/185L/250F /165R/100P/175L A290-7329-X421 /210WE/150U/220U 170CF A290-7329-X421 /210WE/150U/220U 170CF A290-7329-X421 /210WE/220U 170CF A290-7329-X421 /210WE/150U/220U 170CF A290-7329-X421 /210WE/150U/220U 170CF A290-7329-X421 /210WE/220U 170CF A290-X420 /210WE/220U 1700 165F/165R/150U A290-7324-Z425 210F/185L/250F/200R A290-7329-Y425 /100P/175L/210WE /220U 170CF A290-7329-Y425 /100P/175L/210WE /220U 170CF A290-7329-Y425 /100P/175L/210WE /20U 170CF A290-7329-Y425 /100P/175L/20U 170CF A290-7329-Y425 /100P/175L/20U 170CF A290-7329-Y425 /100P/175L/20U 170CF A290-7329-Y420-Torque N-m (kgf-m) LT243 16.7 (1.7) 3 9 9 1 1 1 3 3 1 2 3 Fig. 4.6 (a) Replacing the motor (M4, M5, M6) for wrist axis (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/210WE/125L/175L/150U/220U) - 111 - 4.REPLACING PARTS 7 B-82235EN/08 7 6 5 4 1 7 6 5 3 2 4 1 J5 3 2 J4 Parts name 1 2 3 4 5 6 7 MOTOR BOLT WASHER GEAR J41 (J4-10) (J axis gear) GEAR J51 (J5-axis gear) WASHER NUT O-RING Specifications Q'ty A06B-0238-B605#S000 A6-BA-8X20 A97L-0001-0823#M8H 2 6 6 A290-7327-X425 1 (Appended to the motor) JB-OR1A-G105 2 2 2 Locking Torque N-m (kgf-m) LT243 16.7 (1.7) Fig. 4.6 (b) Replacing the motor (M4, M5, M6) for (M4, M6) wrist axis (R-2000iB/100H) - 112 - 4.REPLACING PARTS B-82235EN/08 J6 J5 J4 R-2000iB/165F/210F/185L/250F/210WE/165R/200R/100P/125L/175L/150U/220U/165CF J5 J4 J6 J5 J4 R-2000iB/165CF) Remove 1 2 3 4 5 6 7 8 Set dial gauges at the J4 to J6-axis, and prepare for single axis mastering after replacement. Place the wrist in a posture in which no load is applied to the wrist axis. Turn off the controller power. By Fig. 4.6 (c), confirm the position of the motor that is exchanged. Detach the three cable connectors from the motor (1). Remove the three motor mounting bolts (2) and washers (3). Pull out the motor (1), while being careful not to damage the surface of the gear teeth. For the J4-axis motor, remove the O-ring (4), nut (7), and then remove the gear (10) (including bearing (9) and C-ring (8)). For the J5/J6-axis motor, remove the O-ring (4), nut (7), and then remove the gear (10) (including bearing (9) and C-ring (8)). gear (5). Assembling 1 2 3 4 5 6 7 Polish the flange surface of the motor (1) using an oilstone. For the J4-axis motor, fix the gear (10) to the motor (1), attach the bearing (9) and C-ring (8) to the gear (10) with the jig (A290-7321-X947). For the J5-(J) and mount the motor (1) while being careful not to damage the surface of the gear teeth. Also note the orientation in which the motor (1) is mounted. Attach the three motor mounting bolts (2) and washers (3). Attach the three cables (2) and washers (3). connectors to the motor (1). Apply grease to the J4-axis gearbox. (See Section 2.3.) Perform single axis mastering for J4/J5/J6-axes referring to Section 8.6 of the Operator's Manual. - 113 - 4.REPLACING PARTS B-82235EN/08 NOTE 1 When tightening the nut (11), hold the gear (10) with a 30x32mm or 32x36mm spanner (Thickness is 14mm or less) 2 To install a motor, an M8 T-shaped hexagonal wrench not shorter than 200mm is required. 23 4 J6 5 67 1 23 J5 4 J4 4 1 5 67 1 8 9 10 7 11 23 Parts name 1 2 3 4 5 6 7 8 9 10 11 MOTOR BOLT WASHER O-RING GEAR J51 0823#M8H JB-OR1A-G105 A290-7321-Y423 A290-7321-Y425 A97L-0001-0610#10 A6-N1-10X1.25S-M-N1 A6-CJR-30 A97L-0218-0428#0600000 A290-7321-Y421 A290-7321-Y423 16.7 (1.7) Fig. 4.6 (d) Replacing the wrist axis motors (M4, M5 and M6) (R-2000iB/165CF) - 114 4.REPLACING PARTS B-82235EN/08 Replacing the wrist unit and J4-axis reducer (R-2000iB/165F/165R/170CF/125L/150U) Remove 1 2 3 4 5 Set dial gauges at the J4 to J6-axis, and prepare for single axis mastering after replacement. Turn off the controller power. Remove the load, such as the hand and workpiece from the wrist. Remove the wrist unit mounting bolt (1), washer (2) and O-ring (3) then remove the reducer (6). Mount the reducer (6) on the J3 arm, and fasten them with the reducer mounting bolt (4) and washer (5), and O-ring (7) to the reducer (6). Attach the O-ring (3) to the groove in the reducer side. Fasten the wrist unit with the wrist unit mounting bolt (1) and washer (2). Apply grease to the wrist. (See Section 2.3.) Perform single axis mastering for-J4/J5/J6-axes referring to Section 8.6 of the Operator's Manual. 3 4 5 6 7 6 5 4 3 2 1 Parts name 1 2 3 4 5 6 7 BOLT WASHER O-RING BOLT WASHER REDUCER O-RING Specifications A6-BA-8X35 A97L-0001-0823#M8H JB-OR1A-G115 A6-BA-8X35 A97L-0001-0823#M8H A97L-0218-0385#70N-35 A98L-0040-0041#260 Q'ty Locking Torque N-m (kgf-m) 18 18 1 16 16 1 1 LT263 37.2 (3.8) LT263 37.2 (3.8) Fig. 4.6 (e) Replacing the wrist unit and J4-axis reducer (R-2000iB/165F/165R/170CF/125L/150U) - 115 - 4.REPLACING PARTS B-82235EN/08 Replacing the wrist unit and J4-axis reducer (R-2000iB/210F/185L/250F/200R/100P/210WE/175L/220U) Remove 1 2 3 4 5 Set dial gauges at the J4 to J6-axis, and prepare for single axis mastering after replacement. Turn off the controller power. Unload the wrist by removing the hand and any workpiece. Remove the wrist unit mounting bolt (1), washer (2), and O-ring (7) and then remove the reducer (6) from the J3 arm. Assembling 1 2 3 4 5 6 7 Install the O-ring (7) onto the groove of the end face of the reducer (6) Mount and fasten the reducer (6) to the J3 arm with the reducer mounting bolt (4) and washer (5). Install the O-ring (3) in the wrist unit with the wrist unit mounting bolt (1) and washer (2). Apply grease to the wrist referring to Section 2.3. Perform single axis mastering for J4/J5/J6-axes referring to Section 8.6 of the Operator's Manual. 7 6 5 4 3 2 1 Parts name 1 BOLT 2 WASHER 3 O-RING 4 BOLT 5 WASHER 6 REDUCER 7 O-RING Specifications Except 210WE A6-BA-8X40 A97L-0218-0432#8X40 A97L-0218-0432#M8H A97L-0218-0435#M8H A97L-0218-0435#M8H A97L-0218-0435#M8H A97L-0218-0435#M10H A97L-0218-045#M10H A97L-021 (3.8) LT263 73.5 (7.5) 24 1 12 12 1 1 Fig. 4.6 (f) Replacing the wrist unit and J4-axis reducer (R-2000iB/210F/185L/250F/200R/100P/210WE/175L/220U) - 116 - 4.REPLACING PARTS B-82235EN/08 LOCTITE 518 applying area ロックタイト518塗布範囲 Fig. 4.6 (g) Applying sealant to the J4-axis reducer (R-2000iB/210F/185L/250F/200R/100P/210WE/175L/220U) - 116 - 4.REPLACING PARTS B-82235EN/08 LOCTITE 518 applying area 2000iB/210F/185L/250F/200R/100P/210WE/175L/220U) - 117 - 4.REPLACING PARTS B-82235EN/08 Replacing the wrist unit (R-2000iB/100H) Remove 1 2 3 4 Set dial gauges at the J4/J5-axis, and prepare for single axis mastering after replacement. Turn off the controller power. Remove the load, such as the hand and workpiece from the wrist. Remove the spring pin (1), wrist unit mounting bolt (2) washer (3), and O-ring (4), then remove the wrist unit. Assembling 1 2 Attach O-ring (4) to the wrist unit mounting bolt (2) and washer (3). J4/J5-axes referring to Section 8.6 of the Operator's Manual. 3 4 4 3 2 1 Parts name 1 2 3 4 SPRING PIN BOLT WASHER O-RING Specifications Q'ty A6-PS-8X30 A6-BA-8X35 A97L-0001-0823#M8H JB-OR1A-G115 2 16 16 1 Locking Torque N-m (kgf-m) LT263 37.2 (3.8) Fig. 4.6 (h) Replacing the wrist unit (R-2000iB/100H) - 118 - 4.REPLACING PARTS B-82235EN/08 Replacing the wrist unit and J4-axis reducer (R-2000iB/165CF) Remove 1 2 3 4 5 6 Set dial gauges at the J4 to J6-axis, and prepare for single axis mastering after replacement. Turn off the controller power. Remove the hand, workpiece, or other loads from the wrist unit mounting bolt (1), washer (2), and O-ring (3) and then remove the wrist unit. Remove the adapter (6) and then remove the reducer (7) from the adapter (4). Remove the reducer (7) from the adapter (1). Assembling 1 2 Apply sealant (see Section 4.9, "SEALANT APPLICATION"). Place the new O-ring (10) in the specified position, mount the reducer (7) on the adapter (11), and secure the reducer with the reducer mounting bolt (8) and washer (9). Mount the adapter (11), and secure it with the wrist unit mounting bolt (1) and washer (2). Apply grease to the wrist referring to Section 2.3. Perform single axis mastering for-J4/J5/J6-axes referring to Section 8.6 of the Operator's Manual. 3 4 5 6 7 8 9 10 11 BOLT WASHER O-RING ADAPTER BOLT WASHER O-RING ADAPTER Specifications A6-BA-8X30 A97L-0001-0823#M8H A98L-0001-0347#S125 A290-7321-X413 A6-BA-8X20 A97L-0001-0823#M8H A97L-0218-0240#80E-37 A6-BA-8X30 A97L-0001-0823#M8H A290-7302-X552 A290-7321-X412 Q'ty Locking Torque N-m (kgf-m) 16 16 1 1 LT263 37.2 (3.8) LT263 LT 2000iB/165CF) - 119 - 4.REPLACING PARTS 4.7 B-82235EN/08 REPLACING THE FANS When R-2000iB/100P and press handling package is specified, robot is equipped with cooling fans for the J1/J2-axis motors. The procedure for replacing the fans is the same for all axes. The following example describes the procedure for the J2-axis. Disassembling 1 2 3 Turn off the controller power. Remove bolts (1), washers (2), and fan cover assy (3) and secure it with bolts (1) and washers (2). At this time, be careful not to break the Pulsecoder connector of the motor. Connect the fan cable. 2 1 3 2 Parts name 1 2 3 BOLT WASHER FAN COVER ASSY Specifications Q'ty A6-BA-8X12 A6-WM-8S A290-7329-V606 2 2 1 Fig. 4.7 Replacing fan - 120 - Locking Torque N-m (kgf-m) 4.REPLACING PARTS B-82235EN/08 4.8 REPLACING THE BALANCER Replacement procedure (R-2000iB/165F/210F/185L/250F/125L/175L/100H) Remove 1 2 3 4 5 6 7 8 Place the robot in the posture of J2=0°. Turn off the controller power. (R-2000iB/165F/210F/125L/175L/100H) Remove the bolt (2) and cover (3), and attach two M12 eyebolts to the balancer, then lift the balancer with a crane. (R-2000iB/185L/250F) Remove button bolt (1), bolt (2) and cover (3), and attach M8 and M12 eyebolts to the balancer, then lift the balancer with a crane. Loosen the U nut (4) so that no tension is applied to the balancer. Remove the bolt (5). Remove the bolt (6) and washer (7), then pull out the shaft assembly (8). Remove the bolt (9) then remove the shaft (10). (2 places) Lift the balancer assembly (11). Assembling 1 2 3 4 5 6 7 Determine the shaft so that grease passage may come to the vertical direction. (See Fig 4.8 (g).) Lay down the balancer with the crane. Next, remove the sling from the balancer then lift the balancer with the sling on the front shaft side only. Determine the position of the front shaft then insert the shaft (8) so that the tapped hole is positioned vertical. Next, install the bolts (5) so that the balancer does not move horizontally. At this time, tighten the bolts one by one gradually while adjusting the position of the balancer so that the outer ring is not damaged. Tighten the U nut (4) by the specified torque then secure the cover (3) with the mounting bolt (2). (R-2000iB/165F/210F/125L/175L/100H) Lay down the balancer with the crane then remove the two M12 evebolts. (R-2000iB/185L/250F) Lav down the balancer with the crane then remove the M8 and M12 eyebolts. Supply grease to the grease nipple attached to the shaft (10). (See Section 2.1.) WARNING Never disassembled without using a special jig, the internal spring will extend, and can expose you to danger. When replacing the balancer, be sure to replace the balancer unit. NOTE To attach the U-nut, mount the M33 socket with a diagonal side length of 50 mm on a torque wrench and perform tightening. - 121 - 4. REPLACING PARTS B-82235EN/08 9 10 A Eyebolts (M12) アイボルト (M12) 6 11 8 7 4 9 3 2 10 5 Remove four bolts of outside. 外側の4つのボルトを外 す Grease nipple グリースニップル Detail 詳細AA Parts name 2 3 4 5 6 7 8 9 BOLT COVER U NUT BOLT BOLT WASHER SHAFT ASSY BOLT 10 SHAFT 11 BALANCER ASSY Specifications Q'ty A6-BA-6X10 A290-7324-X391 A97L-0001-0660#BMN133 A6-BA-6X10 A290-7324-X391 A97L-0001-0720+X391 A97L-0001-0660#BMN133 A6-BA-6X10 A290-7324-X391 A97L-0001-0660#BMN133 A6-BA-6X10 A97L-0001-0823#M6H A97L-0001-0823#M6H A97L-0001-0823#M6H A97L-0001-0823#M6H A97L-0001-0823#M6H A97L-0001-0823#M6H A97L-0001-0823#M6H A97L-0001-0823#M6H A97L-0001-0823#M6H A97L-0001-0824 7329-X384 A6-BA-6X10 (4) 165F 125L A290-7329-V301 100H 210F A290-7329-V302 175L Locking 2 1 1 2 4 4 1 4 2 1 Fig. 4.8 (a) Replacing the balancer (R-2000iB/165F/210F/125L/175L/100H) - 122 - Torque N-m (kgf-m) 319 (32.5) 4.REPLACING PARTS B-82235EN/08 9 10 A 6 Eyebolts アイボルト (M8) (M8) 11 7 8 4 アイボルト Eyebolts (M12) (M12) 1932105 Grease nipple グリースニップル Remove four bolts of outside. 外側の4つのボルトを外す Detail 詳細AA Parts name 1234567891011 BUTTON BOLT SHAFT ASSY BOLT ASSY BOLT SHAFT ASSY BOLT SHAFT ASSY BOLT SHAFT ASSY BOLT S 0660#BMN133 A6-BA-6X16 A6-BA-6X16 A6-BA-6X10 A290-7324-X382 A290-7324-Remove 1 2 3 4 5 6 7 Place the robot in the posture of J2=-90^o. Turn off the controller power. Remove the bolt (1) and cover (2), attach two M12 eyebolts to the balancer, and hoist it with a crane. Loosen the U-nut (3) so that the tension of the balancer is not applied. Remove the bolt (4) and washer (5) and then pull out the shaft assembly (6). Remove the bolt (7), washer (8), and grease nipple (10) and then pull out the shaft (9). (2 places) Hoist the balancer (11). Assembling 1 2 3 4 5 6 Determine the position of the rear shaft of the balancer, insert the shaft (9), and attach the bolt (7), washer (8), and grease nipple (10). Install the shaft so that grease passage may come to the vertical direction. (See Fig. 4.8 (g). Lower the crane once, remove the sling at the back of the balancer, and hoist the balancer with only the specified torque and fix the cover (2) with the mounting bolt (1). Remove the balancer from the crane and then remove the two M12 eyebolts. Supply grease to the grease nipple attached to the shaft (9) (see Section 2.1.). WARNING Never disassemble the balancer is disassembled without using a special jig, the internal spring will extend, and can expose you to danger. When replacing the balancer, be sure to replace the balancer unit. NOTE To attach the U-nut, mount the M42 socket with a diagonal side length of 65 mm on a torque wrench and perform tightening. - 124 - 4.REPLACING PARTS B-82235EN/08 87 10 9 6 アイボルト(M12) 0823#M12H A290-7324-V361 A6-BA-8X20 A97L-0001-0823#M8H A290-7324-V382 A97L-0218-0013#A610 A290-7324-V311 Q'ty Locking 2 1 1 8 8 1 8 8 2 2 1 Fig. 4.8 (c) Replacing the balancer (R-2000iB/165R/200R/100P) - 125 - Torque N-m (kgf-m) 319 (32.5) 4.REPLACING PARTS B-82235EN/08 Replacement procedure (R-2000iB/210WE) (A05B-1329-B255) Remove 1 2 3 4 5 6 7 8 9 10 11 Place the robot in the posture of J2=0°. Turn off the controller power. Remove the bolt (1), cover (2) and gasket (3), attach two M12 eyebolts to the balancer, and hoist it with a crane. Loosen the U-nut (4) so that the tension of the balancer is not applied. Remove bolt (5). Remove the bolt (6) and then pull out the shaft assembly (8). Remove the bolt (12). Hoist the balancer (12). Assembling 1 2 3 4 5 6 7 8 9 Determine the position of the rear shaft of the balancer, insert the shaft (11), and attach the bolt (9). Install the shaft (11) so that grease passage may come to the vertical direction. (See Fig. 4.8 (h).) Lower the shaft (11) so that grease passage may come to the vertical direction of the front shaft (8) so that the draw tap positions vertical, and attach the bolts (5) so that the balancer does not move horizontally. At this time, tighten the bolts (5) so that the balancer does not move horizontally. At this time, tighten the bolts (5) so that the balancer does not move horizontally. the specified torque and fix the cover (2) with the mounting bolt (1). In this time, replace gasket (3) by new one. Remove the balancer from the crane and then remove the balancer from the crane and then remove the balancer from the crane and then remove the balancer back side joint (13) and attach bolts (14) and plate (15). balancer lower side plate and connect tube to balancer back side joint. WARNING Never disassembled without using a special jig, the internal spring will extend, and can expose you to danger. When replacing the balancer, be sure to replace the balancer unit. NOTE To attach the U-nut, mount the M33 socket with a diagonal side length of 50 mm on a torque wrench and perform tightening. NOTE Oil seal is attached to the balancer unit shaft (10)'s insert hole. When inserting shaft (10), be careful not to damage oil seal. - 126 - 4.REPLACING PARTS B-82235EN/08 9 10 11 A 6 7 8 4 3 アイボルト (M12) (M12) Eyebolts 2 1 9 10 11 アイボルト (M12) Eyebolts (M12) 12 Remove外側の4つのボルトを外す four bolts of outside. グリースニップル Grease nipple 13 Detail A 詳細 A 15 14 Parts name 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 BOLT COVER GASKET U NUT BOLT BOLT WASHER SHAFT ASSY BOLT GREASE NIPPLE SHAFT BALANCER ASSY JOINT BOLT 1 2 4 4 1 8 2 2 1 1 2 1 Replacing the balancer (R-2000iB/210WE (A05B-1329-B255)) - 127 - Torque N-m (kgf-m) 319 (32.5) 4. REPLACING PARTS B-82235EN/08 Replacement procedure (R-2000iB/210WE) (A05B-1329-B255)) - 127 - Torque N-m (kgf-m) 319 (32.5) 4. Replacing the balancer (R-2000iB/210WE) (A05B-1329-B255)) - 127 - Torque N-m (kgf-m) 319 (32.5) 4. Replacing the balancer (R-2000iB/210WE) (A05B-1329-B256) Remove 1 2 3 4 5 6 7 8 9 10 11 Place the robot in the posture of I2=0°. Turn off the controller power. Remove the tube of balancer back side. Remove the plate of balancer, and hoist it with a crane. Loosen the U-nut (4) so that the tension of the balancer is not applied. Remove bolt (5), seal washer (6) and the seal bolt (7). Remove the bolt (8) and washer (9) and then pull out the shaft assembly (10). Remove the bolt (11) and the washer (9), then pull out the shaft (13). Remove balancer (14). Assembling 1 2 3 4 5 6 7 8 9 Determine the position of the rear shaft of the balancer, insert the shaft (13), and attach the bolt (11). Install the shaft so that grease passage may come to the vertical direction. (See Fig. 4.8 (h).) Lower the sling at the balancer, and hoist the balancer (9). (See Fig.4.8 (f)) Hold the bearing of the shaft by using the bolts (5) and the seal bolt (7) so that the balancer does not move horizontally. At this time, tighten the balancer does not move horizontally. At this time, tighten the balancer does not move horizontally. At this time, tighten the balancer does not move horizontally. At this time, tighten the balancer does not move horizontally. Tighten the U-nut (4) with the specified torque and fix the cover (2) with the mounting bolt (1). In this time, replace gasket (3) by new one. Remove the balancer from the crane and then remove the two M12 eyebolts. Attach balancer back side joint (15) and attach bolts (16) and plate (17). Supply grease to the grease nipple attached to the shaft (13). (see Section 2.1.) Attach balancer lower side plate and connect tube to balancer back side joint. WARNING Never disassembled without using a special jig, the internal spring will extend, and can expose you to danger. When replacing the balancer, be sure

to replace the balancer unit. NOTE To attach the U-nut, mount the M33 socket with a diagonal side length of 50 mm on a torque wrench and perform tightening. NOTE Oil seal is attached to the balancer unit shaft (13)'s insert hole. When inserting shaft (13), be careful not to damage oil seal. - 128 - 4.REPLACING PARTS B-82235EN/08 9 10 11 A 7 12 864321 アイボルト (M12) Eyebolts (M12) 11910 アイボルト (M12) Eyebolts (M12) Remove four bolts of outside. 外側の4つのボルトを外す グリースニップル Grease nipple 7 15 5 17 6 16 Detail A 詳細 A Parts name 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 BOLT COVER GASKET U NUT BOLT SEAL WASHER SEAL BOLT BOLT WASHER SHAFT ASSY BOLT GREASE NIPPLE SHAFT BALANCER ASSY JOINT BOLT PLATE Fig. 4.8 (e) Specification A6-BA-12X16SUS A97L-0218-0432#M5-2 A97L-0218-0432#M5-2 A97L-0218-0432#M5-2 A97L-0218-0432#M6H A290-7329-Y394 A97L-0218-0432#M5-2 A97L-0218-0432#M5-2 A97L-0218-0432#M5-2 A97L-0218-0432#M5-2 A97L-0218-0432#M6H A290-7329-Y394 A97L-0218-0432#M5-2 A97L-0218-0434#M5-2 A97L-0218-0434#M5-2 A97L-0218-044 A290-7324-Y382 A290-7329-V305 A97L-0218-0129#L06-M06 A6-BA-12X16SUS A290-7329-X393 Q'ty Locking 4 1 1 1 1 1 1 4 4 1 8 2 2 1 1 2 1 Replacing the balancer (R-2000iB/210WE (A05B-1329-B256)) - 129 - Torque N-m (kgf-m) 319 (32.5) 4.REPLACING PARTS B-82235EN/08 Please install it so that the pulling out tap may come to this position. Fig. 4.8 (f) Install position of front shaft of balancer (R-2000iB/165F/210F/185L/250F/165R/200R/100P/210WE/125L/175L/100H) この穴が垂直方向に来るように取り付ける事 Install it so that this hole come to the vertical direction. R-2000iB/165F/210F/185L/250F/125L/175L R-2000iB/165F/210F/185L/250F/1 2000iB/165F/210F/185L/250F/165R/200R/100P/125L/175L/100H) - 130 - 4.REPLACING PARTS B-82235EN/08 Install it so that this hole come to the この穴が水平方向に来るように取り付ける事 horizontal direction. R-2000iB/210WE Fig. 4.8 (h) 4.9 Install position of rear shaft (R-2000iB/210WE) SEALANT APPLICATION Washing and degreasing the surfaces to be sealed 1 2 3 4 After dismounting the reducer, apply releasant (LOCTITE 518) becomes softened (for about 10 minutes). Remover etc.) to the arm's surface from which the reducer was dismounted, then wait until the sealant from the surface from which installed the reducer was dismounted. using a spatula. Blow air onto the surface to be sealed and the arm's surface to be sealed and the arm's surface to be sealed, using a cloth dampened with oil and grease remover. Do not spray oil and grease remover. Do not spray oil and grease remover. reducer to be sealed with an oil stone, and degrease it with removal and cleaner again. CAUTION Oil may drip from the inside of the reducer and the member which installed the reducer are dry (with no oil and grease remover remaining). If they are still wet with oil and grease remover, wipe them dry. Always use a new surface of a cloth so that the grease once wiped up with the cloth will not get on the degreased surface. Make sure that no ingredient of oil and grease remover is left, it may prevent stiffening of sealant. Apply sealant (LOCTITE 518) to the surfaces. CAUTION The portions to which sealant is to be applied vary from one axis to another. See descriptions about reducer replacement for the relevant axes for details. - 131 - 4.REPLACING PARTS B-82235EN/08 Assembling 7 8 9 To prevent dust from sticking to the portions to which sealant was applied, mount the reducer as quickly as possible after sealant application. Be careful not to touch the applied sealant. If sealant was wiped off, apply again. After mounting the reducer, wipe off any excessive sealant that comes out from the sealed section with a cloth or spatula. Do not use oil and grease remover. CAUTION Do not grease or move the reducer before the sealant sets, as it may allow grease to leak. Before greasing or moving, wait for about at least one hour after the reducer is mounted. 4.10 REPLACING MOTOR COVERS (OPTION) Replacing the J1-/J2-axis motor cover (R-sealant sets, as it may allow grease to leak. Before greasing or moving, wait for about at least one hour after the reducer is mounted. 2000iB/165F/210F/185L/250F/165R/200R/125L/175L/100H/150U) 1 2 Remove the motor cover. To mount the motor cover. To mount the motor cover. To mount the motor cover A290-7329-X602 J1-axis motor cover A290-7329-X602 J1-axis and two for the J2-axis) and remove the motor cover. To mount the motor cover A290-7329-X602 J1-axis motor cover. Fig. 4.10 (a) Replacing J1/J2-axis motor cover (R-2000iB/165F/210F/185L/250F/125L/175L/100H) - 132 - 4.REPLACING PARTS B-82235EN/08 Bolt M8X16 (3) J2-axis motor cover (R-2000iB/150U) J1-axis motor cover A290-7329-X607 Fig. 4.10 (b) Replacing J1/J2-axis motor cover (R-2000iB/150U) J1-axis motor cover A290-7329-X607 Fig. 4.10 (b) Replacing J1/J2-axis motor cover (R-2000iB/150U) J1-axis motor cover A290-7329-X607 Fig. 4.10 (c) Replacing J1/J2-axis motor cover (R-2000iB/150U) J1-axis motor cover A290-7329-X607 Fig. 4.10 (c) Replacing J1/J2-axis motor cover (R-2000iB/150U) J1-axis motor cover (R-2000iB/150U) J1-axis motor cover A290-7329-X607 Fig. 4.10 (c) Replacing J1/J2-axis motor cover (R-2000iB/150U) J1-axis motor cover A290-7329-X607 Fig. 4.10 (c) Replacing J1/J2-axis motor cover (R-2000iB/150U) J1-axis motor cover A290-7329-X607 Fig. 4.10 (c) Replacing J1/J2-axis motor cover (R-2000iB/150U) J1-axis motor cover A290-7329-X607 Fig. 4.10 (c) Replacing J1/J2-axis motor cover (R-2000iB/150U) J1-axis motor cover A290-7329-X607 Fig. 4.10 (c) Replacing J1/J2-axis motor cover (R-2000iB/150U) J1-axis motor cover A290-7329-X607 Fig. 4.10 (c) Replacing J1/J2-axis motor cover (R-2000iB/150U) J1-axis motor cover A290-7329-X607 Fig. 4.10 (c) Replacing J1/J2-axis motor cover (R-2000iB/150U) J1-axis motor cover A290-7329-X607 Fig. 4.10 (c) Replacing J1/J2-axis motor cover (R-2000iB/150U) J1-axis motor cover A290-7329-X607 Fig. 4.10 (c) Replacing J1/J2-axis motor cover (R-2000iB/150U) J1-axis motor cover A290-7329-X607 Fig. 4.10 (c) Replacing J1/J2-axis motor cover (R-2000iB/150U) J1-axis motor cover A290-7329-X607 Fig. 4.10 (c) Replacing J1/J2-axis motor cover (R-2000iB/150U) J1-axis motor cover A290-7329-X607 Fig. 4.10 (c) Replacing J1/J2-axis motor cover (R-2000iB/150U) J1-axis motor cover A290-7329-X607 Fig. 4.10 (c) Replacing J1/J2-axis motor cover (R-2000iB/150U) J1-axis motor cov Bolt M8X16(3) Bolt M8X16(2) J2-axis motor cover (R-2000iB/165R/200R) (When severe dust/liquid protection is specified) - 133 - 4.REPLACING PARTS B-82235EN/08 Replacing the J1-/J2-axis motor cover (R-2000iB/165R/200R) (When severe dust/liquid protection is specified) - 133 - 4.REPLACING PARTS B-82235EN/08 Replacing the J1-/J2-axis motor cover (R-2000iB/165R/200R) (When severe dust/liquid protection is specified) - 133 - 4.REPLACING PARTS B-82235EN/08 Replacing the J1-/J2-axis motor cover (R-2000iB/165R/200R) (When severe dust/liquid protection is specified) - 133 - 4.REPLACING PARTS B-82235EN/08 Replacing the J1-/J2-axis motor cover (R-2000iB/165R/200R) (When severe dust/liquid protection is specified) - 133 - 4.REPLACING PARTS B-82235EN/08 Replacing the J1-/J2-axis motor cover (R-2000iB/165R/200R) (When severe dust/liquid protection is specified) - 133 - 4.REPLACING PARTS B-82235EN/08 Replacing the J1-/J2-axis motor cover (R-2000iB/165R/200R) (When severe dust/liquid protection is specified) - 133 - 4.REPLACING PARTS B-82235EN/08 Replacing the J1-/J2-axis motor cover (R-2000iB/165R/200R) (When severe dust/liquid protection is specified) - 133 - 4.REPLACING PARTS B-82235EN/08 Replacing the J1-/J2-axis motor cover (R-2000iB/165R/200R) (When severe dust/liquid protection is specified) - 133 - 4.REPLACING PARTS B-82235EN/08 Replacing the J1-/J2-axis motor cover (R-2000iB/165R/200R) (When severe dust/liquid protection is specified) - 133 - 4.REPLACING PARTS B-82235EN/08 Replacing the J1-/J2-axis motor cover (R-2000iB/165R/200R) (When severe dust/liquid protection is specified) - 133 - 4.REPLACING PARTS B-82235EN/08 Replacing the J1-/J2-axis motor cover (R-2000iB/165R/200R) (When severe dust/liquid protection is specified) - 133 - 4.REPLACING PARTS B-82235EN/08 Replacing the J1-/J2-axis lower side motor cover and remove the motor cover. To mount the motor cover, reverse the above mounting procedure steps. In this case, however, first attach the bolts, but keep them loose so that the motor covers can be put in correct place; otherwise the upper motor cover tap may be destroyed. After the motor covers are positioned properly, tighten the bolts. Stainless bolt M8X25 (2) Washer (2) J1-axis motor cover (Upper side) A290-7329-Y607 J2-axis motor cover (Upper side) A290-7329-Y608 Stainless bolt M8X25 (2) Washer (2) J1-axis motor cover (Lower side) A290-7329-Z607 J2-axis motor cover (Lower side) A290-7329-Z608 Stainless bolt M6X10 (3) Washer (3) Fig. 4.10 (d) Replacing J1/J2-axis motor cover (R-2000iB/210WE) (A05B-1329-B256) J1-axis motor cover 1 Remove the M6x10 bolts and washers of lower side motor cover and remove the motor cover. 2 Remove the motor cover. 3 To mount the motor cover, first attach the bolts, but keep them loose so that the motor covers can be put in correct place; otherwise the upper motor cover tap may be destroyed. After the motor covers are positioned properly, tighten the bolts. J2-axis motor cover 1 Remove the bolts M5X10 together with the plate.) 3 Remove the plate. 2 Dismount the motor cover 1 Remove the bolts M5X10 together with the plate. motor cover and the cloth cover, reverse the above mounting procedure steps. Stainless bolt M8x25 (3)(3) ステンレスボルト M8X25 ワッシャ (3) Washer (3) A J1-axis motor cover (上) J1軸モータカバー J2-axis motor cover (A290-7329-X606 Plate A290-7329-X606 Plate A290-7329-X607 (Upper side) A290-7329-X607 (Dpper s M5x10 プレート A290-7329-Z628 J1-axis motor cover (4) (4)ステンレスボルトM5X10 ワッシャ (4) (Lower side) (下) J1軸モータカバー Washer (4) A290-7329-Z607 View A 矢視A Stainless bolt M6x10 (3) ステンレスボルト M6X10 (3) マッシャ (3) Fig. 4.10 (e) Replacing J1/J2-axis motor cover (R-2000iB/210WE) (A05B-1329-B256) 2000iB/165F/210F/185L/250F/165R/200R/210WE(A05B-1329-B255)/125L/ 175L/100H/150U/220U) 1 2 3 Remove the six M6x10 bolts and washers that fasten the lower motor cover, go to step 2. Remove the six M6x10 bolts and washers that fastens the motor cover to J3 casing, then remove the motor covers. To mount the motor covers, reverse the above mounting procedure steps. In this case, however, first attach the bolts, but keep them loose so that the motor covers can be put in correct place; otherwise the upper motor covers can be put in correct place; otherwise the upper motor covers are positioned properly, tighten the bolts. J3/J4/J5/J6 axis motor cover (upper) A290-7329-X603 Bolt $M6 \times 10$ (3) Washer (3) (Fixed to J3 casing) Bolt $M6 \times 10$ (2) Washer (2) (Fixed to J3 casing) Bolt $M6 \times 10$ (3) Washer (3) (Fixed to upper cover) Bolt M6×10 (3) Washer (3) (Fixed to J3 casing) J3/J4/J5/J6-axis motor cover (Lower) A290-7329-X604 Fig. 4.10 (g) Replacing J3/J4/J5/J6axis motor cover (R-2000iB/165F/210F/185L/250F/165R/200R/125L/175L/100H/150U/220U) J3/J4/J5/J6-axis motor cover (Upper side) A290-7329-Y603 Stainless bolt M6X10 (2) Washer (2) (Fixed to J3 casing) Bolt M6X10 (3) Washer (3) (Fixed to J3 casing) J3/J4/J5/J6-axis motor cover (lower side) A290-7329-Y603 Stainless bolt M6X10 (2) Washer (2) (Fixed to J3 casing) Bolt M6X10 (3) Washer (3) (Fixed to J3 casing) J3/J4/J5/J6-axis motor cover (lower side) A290-7329-Y603 Stainless bolt M6X10 (2) Washer (3) (Fixed to J3 casing) Bolt M6X10 (3) Washer (A290-7329-Y604 Stainless bolt M6X10 (4) Washer (4) (Fixed to upper cover) Fig. 4.10 (h) Replacing J3/J4/J5/J6-axis motor cover (R-2000iB/210WE) (A05B-1329-B255) - 136 - 4.REPLACING PARTS B-82235EN/08 Replacing the J3-/J4-/J5-/J6-axis motor cover (R-2000iB/210WE) (A05B-1329-B255)) 1 2 3 4 5 6 Remove the six M4x5 bolts that fastens the upper side and side motor cover, the remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the motor cover C, then remove the five M6x10 bolt and washer that fastens the moto purge air piping. To mount the motor covers and the cloth cover, reverse the above mounting procedure steps. In this case, however, first attach the bolts, but keep them loose so that the upper side motor covers can be put in correct place; otherwise the upper motor covers and the cloth cover, first attach the bolts, but keep them loose so that the upper side motor covers are positioned properly, tighter the bolts. Plate プレート A290-7329-X624 A290-7329-X624 Stainless bolt M4x5 (12) (12) ステンレスボルト M4X5 (Fixed(モータカバーA, Bに固定) to motor cover A 13/J4/J5/J6 axis m (Fixed to J3 casing) J3/J4/J5/J6-axis motor cover B J3/J4/J5/J6軸モータカバーB A290-7329-Y609 A290-7329-Y609 A290-7329-Y609 ステンレスボルト M6X10 (7) (7) Stainless bolt M6x10 ワッシャ (7) Washer (7) (J3ケーシングに固定) (Fixed to J3 casing) Plate A290-7329-Z624 プレート A290-7329-Z624 Stainless bolt M4x5 (10) ステンレスボルト M4X5 (10) (Fixed to motor cover B J3/J4/J5/J6+axis motor cover B J3/J4/J5/J6+axi and C) (モータカバーB,Cに固定) J3/J4/J5/J6-axis motor cover C J3/J4/J5/J6軸モータカバーC A290-7329-Z609 A290-7329-Z609 Stainless bolt M6x10 ステンレスボルト M6X10(3) (3) ワッシャ (3) (3) Washer (J3ケーシングに固定) (Fixed to J3 casing) プレート Plate A290-7329-Y624 A290-7329-Y624 Stainless bolt M4x5 (4)(4) ステンレスボルト M4X5 (モータカバーB,C に固定) (Fixed to motor cover B and C) Fig. 4.10 (i) Replacing J3/J4/J5/J6-axis motor cover (R-2000iB/210WE) (A05B-1329-B256) - 137 - 4.REPLACING PARTS B-82235EN/08 Replacing the J1-/J2-/J3-axis motor cover (R-2000iB/210WE) (A05B-1329-B256) - 137 - 4.REPLACING PARTS B-82235EN/08 Replacing J3/J4/J5/J6-axis motor cover (R-2000iB/210WE) (A05B-1329-B256) - 137 - 4.REPLACING PARTS B-82235EN/08 Replacing the J1-/J2-/J3-axis motor cover (R-2000iB/210WE) (A05B-1329-B256) - 137 - 4.REPLACING PARTS B-82235EN/08 Replacing J3/J4/J5/J6-axis motor cover (R-2000iB/210WE) (A05B-1329-B256) - 137 - 4.REPLACING PARTS B-82235EN/08 Replacing J3/J4/J5/J6-axis motor cover (R-2000iB/210WE) (A05B-1329-B256) - 137 - 4.REPLACING PARTS B-82235EN/08 Replacing J3/J4/J5/J6-axis motor cover (R-2000iB/210WE) (A05B-1329-B256) - 137 - 4.REPLACING PARTS B-82235EN/08 Replacing J3/J4/J5/J6-axis motor cover (R-2000iB/210WE) (A05B-1329-B256) - 137 - 4.REPLACING PARTS B-82235EN/08 Replacing J3/J4/J5/J6-axis motor cover (R-2000iB/210WE) (A05B-1329-B256) - 137 - 4.REPLACING PARTS B-82235EN/08 Replacing J3/J4/J5/J6-axis motor cover (R-2000iB/210WE) (A05B-1329-B256) - 137 - 4.REPLACING PARTS B-82235EN/08 Replacing J3/J4/J5/J6-axis motor cover (R-2000iB/210WE) (A05B-1329-B256) - 137 - 4.REPLACING PARTS B-82235EN/08 Replacing J3/J4/J5/J6-axis motor cover (R-2000iB/210WE) (A05B-1329-B256) - 137 - 4.REPLACING PARTS B-82235EN/08 Replacing J3/J4/J5/J6-axis motor cover (R-2000iB/210WE) (A05B-1329-B20) - 137 - 4.REPLACING PARTS B-82235EN/08 Replacing J3/J4/J5/J5/J6-axis motor cover (R-2000iB/210WE) (A05B-1329-B20) - 137 - 4.REPLACING PARTS B-82235EN/08 Replacing J3/J4/J5/J5/J6-axis motor cover (R-2000iB/210WE) (A05B-1329-B20) - 137 - 4.REPLACING PARTS B-82235EN/08 Replacing J3/J4/J5/J5/J6-axis motor cover (R-2000iB/210WE) (A05B-1329-B20) - 137 - 4.REPLACING PARTS B-8200 - 137 6pcs and remove the motor cover. To mount the motor cover, reverse the above mounting procedure steps. J3-axis motor cover 1 A290-7329-Z602) Bolt M6X10 (2) J3-axis motor cover 1 A290-7329-Z603 Bolt M6X10 (2) J3-axis motor c Replacing J1/J2/J3-axis motor cover, the nemove the six M6x10 bolts and washers that fastens the motor cover, then remove the six M6x10 bolts and washers that fastens the motor cover to J3 casing then remove the motor covers. To mount the motor covers are positioned properly, tighten the bolts, but keep them loose so that the motor covers are positioned properly, tighten the bolts. Bolt M6X10 (2) Washer (2) (Fastend to J3 casing) J4/J5/J6 motor cover (upper) A290-7329-Z605 Bolt M6X10 (2) Washer (2) (Fastend to J3 casing) Fig. 4.10 (k) Replacing Fig. 4.10 (k) Replacing J4/J5/J6-axis motor cover (R-2000iB/170CF) - 138 - Bolt M6X10 Washer (Fastend to J3 casing) 5.REPLACING CABLES B-82235EN/08 5 REPLACING CABLES Replace the cables at the intervals based on every 4 years or 15360 hours, whichever comes first. When the cable is broken or damaged, or shows signs of wear, replace it according to this chapter. Precautions to be observed when handling the Pulsecoder cable during transportation, installation, or maintenance. If the cable with the marking tie is disconnected, mastering must be performed again. Therefore, do not disconnect the cable except when replacement of the motor, the Pulsecoder connectors are provided with a Pulsecoder connectors for cable replacement or other purposes, remove the covers. In this case, turning the bolt may also turn the cover, possibly causing damage to the connector. When removing the cover, hold it to prevent it from turning. Fig. 5 (a) Marking Tie Pulsecoder connector cover Fig. 5 (b) Pulsecoder connector cover - 139 - 5.REPLACING CABLES 5.1 B-82235EN/08 CABLE WIRING Following are the robot cables and the connector wiring. K111/K511 (M1 to M6 Pulsecoder, EE (RI/RO)) K112/K512 (M1 to M6 Pulsecoder, EE (RI/RO)) K133/K533 (Device net (signal)) K133/K533 (Device ne (OT cable) K139/K539 (Additional axis (Pulsecoder)) K140/K540 (Additional axis (power brake)) /K541 (I/O unit model B) Support for SDLP /K542 (Fan cable (J1/J2/J3) /K549 (Fan cable (J1/J2/J3) /K549 (Fan cable (J1/J2/J3) /K578 (User cable (signal line userable to (power supply)) K136/K536 (I/O unit model B) K137 (OT short-circuit cable) K138 the 3DL sensor and force sensor)) /K591 (3DL sensor) /K592 (Camera cable) /K595 (Camera cable) Support for SDLP /K596 (Earth line for camera cable) /K597 (3DL sensor) NOTE) K***/K*** : Standard/CE marking SDLP : Severe Dust/Liquid Protection Fig. 5.1 (a) Routing of the robot cables (R-2000iB/165F/210F/185L/250F/125L/175L/150U) /K615 (M1 to M6 Pulsecoder, EE (RI/RO)) Support for SDLP(*1) K231/K631 (User cable(signal)) K232/K632 (User cable(power supply)) K233/K633 (Device net(signal)) K235/K635 (Device net(power supply)) K236/K636 (I/O unit K211/K611 (M1 to M6 Pulsecoder, EE (RI/RO)) K212/K612 (M1 to M6 power, brake) /K613 (M1 to M6 Pulsecoder) (*1) model B) K137 (OT short-circuit cable) K238 (OT cable) K239/K639 (Additional axis (Pulsecoder)) K240/K640 (Fan cable (J1/J2/J3)) /K645 (Fan cable (J1/J2/J3)) /K6 usable to 3DL sensor and force sensor) //K691 (3DL sensor) (*1) //K692 (Camera cable)(*1) //K695 (Camera cable)(*1) //K695 (Camera cable)(*1) //K697 (3DL sensor) (*1) //K6 cables (R-2000iB/165R/200R/100P) - 140 - 5.REPLACING CABLES B-82235EN/08 K311/K711 (M1 to M6 Pulsecoder, EE (RI/RO)) K332/K732 (User cable (signal)) K332/K732 (User cable (signal)) K332/K733 (Device net (signal)) K335/K735 (Device net (signal)) K332/K731 (User cable (signal)) K332/K732 net (power supply)) K336/K736 (I/O unit model B) K137 (OT short-circuit cable) K338 (OT cable) K338 (OT cable) K338/K739 (Additional axis (power, brake)) NOTE) K***/K*** : Standard/CE marking SDLP : Severe dust/liquid protection Fig. 5.1 (c) Routing of the robot cables (R-2000iB/170CF) K527 (M1 to M6 power, brake)) NOTE) K***/K*** : Standard/CE marking SDLP : Severe dust/liquid protection Fig. 5.1 (c) Routing of the robot cables (R-2000iB/170CF) K527 (M1 to M6 power, brake)) K528 (M1 to M6 Pulsecoder) Fig. 5.1 (d) Routing of the robot cables (R-2000iB/210WE) - 141 - 5.REPLACING CABLES B-82235EN/08 K116/K516 (M1 to M5 power, brake) /K530 (Fan cable (J1/J2)) K131/K531 (User cable (signal)) K132/K532 (User cable (power supply)) K133/K533 (Device net (signal)) K135/K535 (Device net (power supply)) K136/K536 (I/O unit model B) K137 (OT short-circuit cable) K138 (OT cable) K139/K539 (Additional axis (power, brake)) /K545 (Fan cable (J1/J2/J3)) /K545 (Fan cable (J1/J2/ Routing of the robot cables (R-2000iB/100H) /K519 /K520 /K531 /K532 /K533 /K535 /K536 (M1 to M6 Pulsecoder, EE (RI/RO)) (User cable (signal)) (Devicenet (signal)) (Devicenet (power, J2J3)) (I/O unit model B) K137 (OT short-circuit cable) K138 (OT cable) /K539 (Additional axis (Pulsecoder)) /K540 (Additional axis (power, brake)) 注) K**/K*** : Standard/CE marking Fig. 5.1 (f) Routing of the robot cables (R-2000iB/220U) - 142 - 5.REPLACING CABLES B-82235EN/08 K123/K523 (M1 to M6 Pulsecoder, EE (RI/RO)) K115/K515 (M1 to M6 Pulsecoder, EE (RI/RO)) K115/K515 (M1 to M6 Pulsecoder, EE (RI/RO)) K144/K546 (User cable (signal)) K144/K546 (User cables (R-2000iB/220U) - 142 - 5.REPLACING CABLES B-82235EN/08 K123/K523 (M1 to M6 Pulsecoder, EE (RI/RO)) K115/K515 (M1 to M6 Pulsecoder (power supply)) K273/K542 (Device net (signal)) K274/K543 (Device net (signal)) K274/K543 (Device net (power supply)) K291/K281 (I/O unit model B) K282 (OT cable) K282 (OT cable) K286/K544 (Additional axis (power supply)) NOTE) K**/K*** Standard/CE marking Fig. 5.1 (g) (M5M, M5P, M5BK) Routing of the robot cables (R-2000iB/165CF) (M6M M6P, M6BK) (EE) (M4M, M4P, M4BK) (M3M, M3P, M3BK) (OPTION: AS2,ASH2,ASi2,AP2, I/O, AIR A2, AIR B2, DS3, DP3, ARP2, ARM2 CAM2,SEN2) (OPTION: AS1, ASH1,ASi1,AP1, I/O, AIR A1, AIR B1, DS1, DP1, ARP1, ARM1 CAM1,SEN1) (M2M, M2P, M2BK) Fig. 5.1 (h) Connector wiring (R-2000iB/165F/210F/185L/250F/125L/175L/150U/220U) - 143 - 5.REPLACING CABLES B-82235EN/08 (M5M,M3P,M3BK) (OPTION:DS2,DP2) (RM1) (RP1) (OPTION: AS1,ASH1,ASi1,AP1,I/O AIR A2,AIR B1, DS1,DP1,ARP1,ARM1, CAM1,SEN1) (EE) (OPTION: AS2,ASH2,ASi2,AP2,I/O AIR A2,AIR B2, DS3,DP3,ARP2,ARM2, CAM2,SEN2) Fig. 5.1 (i) Connector wiring (R-2000iB/165R/200R) (M3M,M3P,M3BK,FAN3) (M1M,M1P,M1BK,FAN1) (RM1) (RP1) (OPTION: AS1,AP1,I/O, AIR A1,AIR B1 DS1,DP1,ARP1,ARM1) (M2M,M2P,M2BK) (M3M,M3P,M3BK,FAN3) (M1M,M1P,M1BK,FAN1) (RM1) (RP1) (OPTION: AS1,AP1,I/O, AIR A1,AIR B1 DS1,DP1,ARP1,ARM1) (M2M,M2P,M2BK) (M3M,M3P,M3BK,FAN3) (M1M,M1P,M1BK,FAN3) (M1M,M1P,M (EE) (OPTION: AS2,AP2,I/O, AIR A2,AIR B2 DS3,DP3,ARP2,ARM2) Fig. 5.1 (j) Connector wiring (R-2000iB/100P) - 144 - 5.REPLACING CABLES B-82235EN/08 (M5M,M5P,M5BK) (M6M,M6P,M6BK) (OPTION: AS2,AP2, I/O, AIR A2, AIR B2, DS3,DP3, ARP2,ARM2) Fig. 5.1 (j) Connector wiring (R-2000iB/100P) - 144 - 5.REPLACING CABLES B-82235EN/08 (M5M,M5P,M5BK) (M6M,M6P,M6BK) (OPTION: AS2,AP2, I/O, AIR A2, AIR B2, DS3,DP3, ARP2,ARM2) Fig. 5.1 (j) Connector wiring (R-2000iB/100P) - 144 - 5.REPLACING CABLES B-82235EN/08 (M5M,M5P,M5BK) (M6M,M6P,M6BK) (OPTION: AS2,AP2, I/O, AIR A2, AIR B2, DS3,DP3, ARP2,ARM2) Fig. 5.1 (j) Connector wiring (R-2000iB/100P) - 144 - 5.REPLACING CABLES B-82235EN/08 (M5M,M5P,M5BK) (M6M,M6P,M6BK) (OPTION: AS2,AP2, I/O, AIR A2, AIR B2, DS3,DP3, ARP2,ARM2) Fig. 5.1 (j) Connector wiring (R-2000iB/100P) - 144 - 5.REPLACING CABLES B-82235EN/08 (M5M,M3P,M3BK) (M6M,M6P,M6BK) (OPTION: AS2,AP2, I/O, AIR A2, AIR B2, DS3,DP3, ARP2,ARM2) Fig. 5.1 (j) Connector wiring (R-2000iB/100P) - 144 - 5.REPLACING CABLES B-82235EN/08 (M5M,M3P,M3BK) (M6M,M6P,M6BK) (M5M,M3P,M3BK) (M6M,M6P,M6BK) (M5M,M3P,M3BK) (M5M,M3P,M3BK) (M6M,M6P,M6BK) (M5M,M3P,M3BK) (M6M,M6P,M6BK) (M5M,M3P,M3BK) (M6M,M6P,M6BK) (M6M,M6P,M6BK) (M5M,M3P,M3BK) (M6M,M6P,M6BK) (M5M,M3P,M3BK) (M6M,M6P,M6BK) (M5M,M3P,M3BK) (M6M,M3P,M3BK) (M6M,M6P,M6BK) (M5M,M3P,M3BK) (M6M,M6P,M6BK) (M5M,M3P,M3BK) (M6M,M6P,M6BK) (M5M,M3P,M3BK) (M6M,M3P,M3BK) (M6M,M3P,M3BK) (M5M,M3P,M3BK) (M6M,M3P,M3BK) (M5M,M3P,M3BK) (M6M,M3P,M3BK) (M6M,M3BK) (M6M (M2M, M2P, M2BK) (OPTION: AS1, AP1, I/O, AIR A1, AIR B1, DS1, DP1, ARP1, ARM1) Fig. 5.1 (k) Connector wiring (R-2000iB/170CF) (M6M, M3P, M3BK) (AIR A2, AIR B2) (M1M, M1P, M1BK) (M2M, M2P, M2BK) (DRY AIR, AIR A1, AIR B1) (RP1) Fig. 5.1 (l) Connector wiring (R-2000iB/210WE) (A05B-1329-B255) - 145 - 5.REPLACING CABLES (M5M, M5P, M5BK) B-82235EN/08 (M4M, M4P, M4BK) (AIR A2, AIR B2) (M3M, M3P, M3BK) (M1M, M1P, M1BK) (M2M, M2P, M2BK) (RM1) (RP1) (DRY AIR A, B, C, AIR A1, AIR B1) Fig. 5.1 (m) Connector wiring (R-2000iB/210WE) (A05B-1329-B255) - 145 - 5.REPLACING CABLES (M5M, M5P, M3BK) (M1M, M1P, M1BK) (M2M, M2P, M2BK) (RM1) (RP1) (DRY AIR A, B, C, AIR A1, AIR B1) Fig. 5.1 (m) Connector wiring (R-2000iB/210WE) (A05B-1329-B255) - 145 - 5.REPLACING CABLES (M5M, M5P, M3BK) (M1M, M1P, M1BK) (M2M, M2P, M2BK) (RM1) (RP1) (DRY AIR A, B, C, AIR A1, AIR B1) Fig. 5.1 (m) Connector wiring (R-2000iB/210WE) (A05B-1329-B255) - 145 - 5.REPLACING CABLES (M5M, M5P, M3BK) (M1M, M1P, M1BK) (M2M, M2P, M2BK) (RM1) (RP1) (DRY AIR A, B, C, AIR A1, AIR B1) Fig. 5.1 (m) Connector wiring (R-2000iB/210WE) (A05B-1329-B255) - 145 - 5.REPLACING CABLES (M5M, M3P, M3BK) (M1M, M1P, M1BK) (M2M, M2P, M2BK) (RM1) (RP1) (DRY AIR A, B, C, AIR B1) Fig. 5.1 (m) Connector wiring (R-2000iB/210WE) (A05B-1329-B255) - 145 - 5.REPLACING CABLES (M5M, M3P, M3BK) (M1M, M1P, M1BK) (M2M, M2P, M2BK) (RM1) (RP1) (DRY AIR A, B, C, AIR B1) Fig. 5.1 (m) Connector wiring (R-2000iB/210WE) (A05B-1329-B255) - 145 - 5.REPLACING CABLES (M5M, M3P, M3BK) (M1M, M1P, M1BK) (M2M, M2P, M2BK) (RM1) (RP1) (DRY AIR A, B, C, AIR B1) Fig. 5.1 (m) Connector wiring (R-2000iB/210WE) (A05B-1329-B255) - 145 - 5.REPLACING CABLES (M5M, M3P, M3BK) (M1M, M3P, M3BK) (M3M, M3BK) (M3M, M3BK) (M3M, M3BK) (M3M, M3BK) (M3M, M3BK) (B256) (EE) (M4M,M4P,M4BK) (M5M,M5P,M5BK) (M1M,M1P,M1BK) (OPTION:DS2,DP2) (RM1) (RP1) (M2M,M2P,M2BK) (OPTION: AS1,AP1,I/O, AIR A1,AIR B1 DS1,DP1,ARP1,ARM1) Fig. 5.1 (n) Connector wiring (R-2000iB/100H) - 146 - (OPTION: AS2,AP2,I/O, AIR A2,AIR B2, DS3,DP3,ARP2,ARM2) 5. REPLACING CABLES B-82235EN/08 (M6M,M6P,M6BK) (M5M,M5P,M5BK) (M4M,M4P,M4BK) (M3M,M3P,M3BK) (OPTION: AS2,AP2,I/O AIR A2,AIR B2, DS3,DP3,ARP2,ARM2) (OPTION: AS1,AP2,I/O AIR A1,AIR B1, DS1,DP1,ARP1,ARM1) (OPTION: I/O) Fig. 5.1 (o) Connector wiring (R-2000iB/165CF) 5.2 CABLE FORMING When replacing cables, clamp the cable at the position specified in Table 5.2 (a) to (r) using a clamp or a cable tie. Otherwise, cables can be loosened or pulled by force to cause their disconnection. Refer to the figures in Section 5.3 for the cable clamp. 1 to 6 mean clamp position below 1 2 3 4 5 6 Clamp position in J1 base Clamp or J2 base Clamp of side of J2 base Clamp of lower part of J2 arm Clamp of upper part of J2 arm Clamp of side of J3 casing - 147 - 5.REPLACING CABLES B-82235EN/08 Table 5.2 (a) Cable clamp position (R-2000iB/165F/210F/185L/250F/165R/200R/100P/125L/175L/150U/220U) Cable Stamp No. Cable clamp position Stamp +6V 0V M1P + 4 BATTERY BACKUP - 3 GB1 D ON 'T M1P-K111 DI SCONNECT コネクタ取外不可 M2P BATTERY BACKUP D ON 'T M2P-K111 DI SCONNECT コネクタ取外不可 M3P K111 BATTERY BACKUP D ON 'T M3P-K111 DI SCONNECT コネクタ取外不可 M2P BATTERY BACKUP D ON 'T M5P-K111 DI SCONNECT コネクタ取外不可 M3P K111 BATTERY BACKUP D ON 'T M5P-K111 DI SCONNECT コネクタ取外不可 M2P BATTERY BACKUP D ON 'T M5P-K111 DI SCONNECT コネクタ取外不可 RP1 BATTERY BACKUP D ON 'T M3P-K111 DI SCONNECT コネクタ取外不可 M2P BATTERY BACKUP D ON 'T M5P-K111 DI SCONNECT コネクタ取外不可 RP1 BATTERY BACKUP D ON 'T M5P-K111 DI SCONNECT コネクタ取外不可 M3P K111 BATTERY BACKUP D ON 'T M5P-K111 DI SCONNECT コネクタ取外不可 M3P K111 BATTERY BACKUP D ON 'T M5P-K111 DI SCONNECT コネクタ取外不可 RP1 BATTERY BACKUP D ON 'T M5P-K111 DI SCONNECT コネクタ取外不可 M3P K111 BATTERY BACKUP D ON 'T M5P-K111 DI SCONNECT コネクタ取外不可 M3P K111 DI SCONNECT コネクタ取り不可 M3P K111 DI SCONNECT コネクタ取り M3P K111 DI SCONNECT コネクタ M3P K1 DI SCONNECT コネクタ取外不可 BATTERY BACKUP DO N'T M6P-K111 5 5 M6M M6BK M6M-K112 3 M5M- K112 M4M-K112 1 2 M6P EE 6 4 RM1 コネクタ取外不可 M5P EE-K111 6 1 DI SCONNECT K211 M4P K511 K519 K611 2 3 4 5 6 2 M3M- K112 M4M K212 M4M K212 M4BK K512 M3M K612 M3BK 3 M1M-K112 M2M- K112 M1BK M2M M2BK M1M M1BK - 148 - 5.REPLACING CABLES B-82235EN/08 Table 5.2 (b) Cable clamp position (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/125L/175L/150U/100H) Cable stamp No. Cable clamp position Stamp K131 AS1 AS2 K231 AS-K131 K331 1 2 3 4 5 6 AP1 AP2 AP-K132 1 2 3 4 5 6 3 1 DS1 4 5 6 2 DS3 DS2 1 DP1 DS3 K133 DS2 K233 K333 DS1-K133 4 3 K132 K232 K332 2 5 6 DP3 DP1-K135 DP2 - 149 - DP3 K135 K235 DP2 K335 5.REPLACING CABLES B-82235EN/08 Table 5.2 (c) Cable clamp position (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/125L/175L/150U/100H) Cable Stamp No. Cable clamp position Stamp 1 2 3 5 4 6 I/O I/O J3OTK138 J2OTK138 J2OTK138 [1230T COM 37 30 OT NC 1 2 3 4 COM NC 1/2 3 4 5 6 ARP1 + ARP-K139 - ARP2 K138 [2COM K238 K338 COM NC]1 NC [1COM]10TK138 1 2 3 4 5 6 ARP1 + ARP-K139 - ARP2 K139 K239 + 6V K339 0V 1 2 3 4 5 6 ARP1 + ARP-K139 + ARP2 K139 K239 + ARP2 K13 (R-2000iB/165F/210F/185L/250F/165R/200R/100P/125L/175L/150U) Cable Stamp No. Cable clamp position +6V 0V M1P + Stamp BATTERY BACKUP - D ON 'T DISC ONNEC T コネクタ取外不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T コネクタ取外不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T コネクタ取外不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T コネクタ取外不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T コネクタ取外不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T コネクタ取り不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T コネクタ取り不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T M2P-K513 コネクタ取り不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T M2P-K513 ロネクタ取り不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T M2P-K513 ロネクタ取り不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T M2P-K513 ロネクタ取り不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T M2P-K513 ロネクタ取り不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T M2P-K513 ロネクタ取り不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T M2P-K513 ロネクタ取り不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T M2P-K513 ロネクタ取り不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T M2P-K513 ロネクタ取り不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T M2P-K513 ロネクタ取り不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T M2P-K513 ロネクタ取り不可 M2P BATTERY BACKUP - D ON 'T DISC ONNEC T M2P-K513 ロネクタ取り (T DISC ONNEC T M2P-K513 ロネクタ (T DISC ONNEC T M2P-K513 DISC ONNEC T M2P-K513 DISC (T DISC ONNEC T M2P-K513 DISC ONNEC T M2P-K513 DISC (T DISC ONNEC T M2P-K513 DISC ONNEC T M2P-K513 DISC (T DISC ONNEC T M2P-K513 DISC ONNEC T M2P-K513 DISC (T DISC ONNEC T M2P-K513 DISC ONNEC T M2P-K513 DISC (T DISC ONNEC T M2P-K513 DISC ONNEC T M2P-K513 DISC (T DISC ONNEC T M2P-K513 DISC ONNEC T M2P-K513 DISC (T DISC ONNEC T M2P-K513 クタ取外不可 RP1 BATTERY BACKUP D ON 'T 1 2 DISC ONN EC T M4P-K513 6 コネクタ取外不可 BATTERY BACKUP K513 M4P K613 M5P D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取外不可 5 4 BATTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取外不可 BATTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取外不可 S 4 BATTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取外不可 S 4 BATTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取外不可 S 4 BATTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取外不可 S 4 BATTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取外不可 BATTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取外不可 S 4 BATTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取外不可 S 4 BATTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取外不可 M2P BA TTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取外不可 S 4 BATTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取外不可 M2P BA TTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取外不可 S 4 BATTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取外不可 S 4 BATTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取外不可 M2P BA TTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取外不可 M2P BA TTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取外不可 S 4 BATTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取り TTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取り TTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 6 BATTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 3 コネクタ取り TTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 6 BATTERY BACKUP D ON 'T DISC ONN EC T M5P-K513 7 A BACKU P DO N'T M2P-K515 RP1 DI SCON NECT コネクタ取外不可 M3P BA TTERY BACKU P DO N'T DI SCON NECT M3P-K515 J 4 コネクタ取外不可 BATTERY B ACKUP D ON 'T M4P-K515 M6P +6V 0V M1P + M6P-K513 DISCO NNECT コネクタ取外不可 K515 M4P K615 1 2 EE-K515 BATTERY B ACKUP D ON 'T DISC ONNECT M5P-K515 3 4 コネクタ取外不可 可 BATTERY B ACKUP D ON 'T 5 M6P-K515 DISCO NNECT コネクタ取外不可 M5P M6P EE 6 - 151 - 5.REPLACING CABLES B-82235EN/08 Table 5.2 (e) Cable clamp position (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/125L/175L/150U/100H/220U) Cable Stamp No. Cable clamp position Stamp 1 2 3 4 5 6 K531 AS2 K631 K731 AS1 AS-6 K532 AP2 K632 K732 AP1 AP-K532 3 1 DS1 4 5 6 2 DS3 DS1-K133 DS2 DS2 3 4 1 DP1 DS3 5 6 2 DP3 DP1-K535 DP2 DP2 1 2 3 4 5 6 I/O I/O-K536 - 152 - K533 K633 K733 K535 K635 K735 K536 K636 K736 5.REPLACING CABLES B-82235EN/08 Table 5.2 (f) Cable clamp position (R 2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/125L/175L/150U/100H/220U) Cable Stamp No. Cable clamp position Stamp 1 2 3 4 5 6 ARP2 ARP1 + ARP-K539 - +6V 0V 1 2 3 4 5 6 K540 ARM2 K640 K740 ARM1 ARM-K540 1 2 3 4 5 K539 K639 K739 6 I/O I/O K541 K641 I/O-K541 1 2 3 4 5 6 ASi2 K578 K678 ASi1 ASi-K578 LMP1 LMP1 1 2 3 4 5 6 3DV1 3DV-K591 - 153 - 3DV2 K591 K691 5.REPLACING CABLES B-82235EN/08 Table 5.2 (g) Cable clamp position (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/125L/175L/150U/100H) Stamp Cable Stamp No. Cable clamp position 1 2 3 4 5 6 CAM1 CAM-K592 1 2 3 5 4 CAM2 K592 K692 6 CAM1 CAM2 CAM-K595 1 2 3 4 5 6 SEN1 SEN2 K597 K5 45 SEN-K597 FAN1 FAN1 K545 K645 FAN FAN K595 K695 1 2 FAN2 FAN2 - 154 - 5.REPLACING CABLES B-82235EN/08 Table 5.2 (h) Cable clamp position (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/125L/175L/150U/100H) Cable Stamp No. Cable clamp position FAN1 K6 42 Stamp FAN FAN1 1 2 FAN2 K542 K642 FAN2 3 4 FAN3 FAN3 6 FAN1 K64 9 5 FAN1 K549 K649 FAN FAN 2 1 FAN2 FAN2 K6 48 FAN1 FAN1 34 5 6 FAN2 FAN FAN FAN 3 1 2 FAN2 - 155 - FAN3 K530 K648 5.REPLACING CABLES B-82235EN/08 Table 5.2 (i) Cable clamp position (R-2000iB/170CF) Cable Stamp No. Cable clamp position Stamp +6V 0V + M1P BATTERY BACKUP DON'T M1P -K311 GB1 DISCONNECT M2P BATTERY BACKUP DON'T M2P-K311 DISCONNECT M3P BATTERY BACKUP DON'T M3P-K311 DISCONNECT R91 K311 BATTERY BACKUP DON'T M4P-K311 Stamp +6V 0V + M1P BATTERY BACKUP - DO N'T M1P-K715 GB1 DISCONNECT コネクタ取外不可 M2P BATTERY BACKUP DO N'T M3P-K715 DISCONNECT コネクタ取外不可 M3P BATTERY BACKUP DO N'T M3P-K715 DISCONNECT コネクタ取外不可 BATTERY BACKUP DO N'T M5P-K715 3 4 DISCONNECT コ ネク 夕取 外 不 可 BATTERY BACKUP DON'T M6P-K715 5 DISCONNECT コ ネク 夕取 外 不 可 M4P M5P M6P EE 6 - 157 - K715 5.REPLACING CABLES B-82235EN/08 Table 5.2 (k) Cable clamp position (R-2000iB/210WE) Stamp Cable clamp position Cable No. M6M M6BK M6M-K527 456 3 M5M-K527 K527 M5BK 2 M4M-K527 M4M M4BK RM1 1 1 34 56 2 M3M M3BK M3M-K527 M3BK 2 3 M2M M2BK M1M-K527 M2BK 2 3 M2M ŠO s Å GB1 M2P-K528 M3P BATTE RY BAC KUP D ON'T DISCO NNECT 1 2 M4P-K528 R I N ^Žæ ŠO s Å BATT ERY BA CKUP DON 'T DISCO NNECT 1 2 M4P-K528 R I N ^Žæ ŠO s Å BATT ERY BA CKUP DON 'T DISCO NNECT M6P-K528 6 - 158 - R I N ^Žæ ŠO s Å DO N'T M3P-K116 DISCONNECT コネクタ取外不可 RP1 K116 K516 1 2 BATTERY BACKUP DON 'T M4P-K116 3 4 5 DISCONNECT コネクタ取外不可 EE-K116 6 M5P EE 6 M5M M5BK 5 M5M-K117 4 3 3 4 5 2 RM1 M4M-K117 1 1 M3M-K117 6 2 M1M-K117 M2M-K117 M4M M4BK M3M M3BK K117 K517 M2M M2BK M1BK M1M M1BK - 159 - 5.REPLACING CABLES B-82235EN/08 Table 5.2 (m) Cable clamp position (R-2000iB/220U) Cable clamp position (R-2000iB/220U) Cable clamp position Stamp 6 5 M5M M5BK M6M-K520 4 3 M5M-K520 3 2 4 5 RM1 1 M4M-K520 2 6 RM2 M1M-K520 M2M-K520 M4M M4BK M6M M6E M3M M3BK K520 M2M M2BK M1BK M1M M1BK - 160 - 5.REPLACING CABLES B-82235EN/08 Table 5.2 (n) Cable clamp position (R-2000iB/165CF) Cable Stamp No. Cable clamp position (R-2000iB/165CF) Cable Stamp No. Cable clamp position (R-2000iB/165CF) Cable Stamp No. Cable clamp position +6V 0V M1P + Stamp B ATTER Y B ACK UP - D ON 'T DI SC ON NE CT M1P-K123 GB1 コネク 夕取 付不可 M2P B ATTER Y B ACK UP D ON 'T DI SC ON NE CT M2P-K123 コネクタ取付不可 M3P B ATTER Y B ACK UP D ON 'T DI SC ON NE CT M3P-K123 コネクタ取付不可 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 M5P 3 4 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 M5P 3 4 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付不可 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ取付 RP1 BA TTERY BAC KU P DO N 'T DIS CO NN EC T M4P-K123 コネクタ K123 コネクタ取付不可 M6P EE-K123 5 6 5 4 EE M6M M6BK 6 M6M-K115 M5M K515 M2M K115 2 3 4 5 6 RM1 1 M3M-K115 2 3 4 5 6 RM1 1 M3M Cable Stamp No. Cable clamp position Stamp 1 2 3 4 5 6 AS1 AS2 K143 AS-K143 1 2 3 4 5 6 AP1 AP2 K144 AP-K144 3 1 DS1 4 5 6 2 DS3 K273 DS1-K273 DS2 DP2 DP2 3 4 5 6 I/O K291 I/O I/O-K282 - 162 - 5.REPLACING CABLES B-82235EN/08 Table 5.2 (p) Cable clamp position (R-start of the clamp position and the 2000iB/165CF) (NON-CE) Cable Stamp No. Cable clamp position NC 4 3 J3OTK282 COM X D-3 123 NC 1 2 OT J2OTK282 COM Stamp J3 NC J1COM J1OTK282 1 2 3 4 5 6 ARP2 K221 - +6V 0V 1 2 3 4 5 6 ARM1 ARM2 K286 ARM-K286 - 163 - 5.REPLACING CABLES B-82235EN/08 Table 5.2 (q) Cable clamp position (R-2000iB/165CF) (CE) Cable Stamp No. Cable clamp position Stamp 1 2 3 4 5 6 AP1 AP2 K546 AP-K546 3 4 5 2 1 DS1 6 DS3 K542 DS1-K133 DS2 DS2 DP2 DP2 3 4 5 6 2 DP1 DS3 DP4 DP4 K543 DP1-K134 1 DP3 DP3 1 2 3 4 5 6 I/O K281 I/O I/O-K281 - 164 - 5. REPLACING CABLES B-82235EN/08 Table 5.2 (r) Cable clamp position (R-2000iB/165CF) (CE) Stamp Cable clamp position Cable Stamp No. 1 2 3 4 5 6 ARP1 ARP2 K545 + ARP-K545 - +6V 0V 1 2 3 4 5 6 ARP1 ARP2 K545 + ARP-K545 + +6V 0V 1 2 3 4 5 6 ARP1 ARP2 K545 + +6V 0V 1 2 3 4 5 6 ARP1 ARP2 K545 + +6V 0V 1 2 3 4 5 6 ARP1 ARP2 K545 + +6V 0V 1 2 3 4 5 6 ARP1 ARP2 K545 + +6V 0V 1 2 3 4 5 6 ARP1 ARP2 K545 + +6V 0V 1 2 3 4 5 6 ARP1 ARP2 K545 + +6V 0V 1 2 3 4 5 6 ARP1 ARP2 K545 + +6V 0V 1 2 3 4 5 6 ARP1 ARP2 K545 + +6V 0V 1 2 3 4 5 6 ARP1 ARP2 K545 + +6V 0V 1 2 3 4 5 6 ARP1 ARP2 K545 + +6V 0V 1 2 3 4 5 6 ARP1 ARP2 K545 + +6V 0V 1 2 3 4 5 6 ARP1 ARP2 K545 + +6V 0V 1 2 3 4 5 6 ARP1 ARP2 K545 + +6V 0V 1 2 3 4 5 6 ARP1 ARP2 K545 + +6V 0V 1 2 3 4 5 6 ARP1 ARP2 K545 + +6V 0V 1 2 3 4 5 6 ARP1 ARP2 K replacing all the (full-option) mechanical unit cables. If you need to replace a specific cable (because, for example, it is damaged), do so by adopting the appropriate procedures. If replacing mechanical unit cables by kit, replace limit switch for detection of over travel, too. If over travel is not used, prepare short circuit wire. See Section 5.1 for the configuration of the mechanical unit cables. Cable replacement makes it necessary to perform mastering. Before attempting replacement, therefore, see Chapter 6 MASTERING. 5.3.1 Replacement Procedure (R-2000iB/165F/210F/185L/250F/125L /175L/100H/150U/220U) Remove the cables as the following procedure. 1 Set the Quick Mastering. Reference Position referring to Section 8.4,8.5 of the Operator's Manual. (All the axes are set to 0^o before shipment.) 2 Place all the robot axes in their 0-degree position, then turn off the controller power. 3 Detach the cable leading to the controller from the J1 base, then detach all the cable and air tubes from the connector panel. Remove the terminal on the rear of the battery box and the earth terminal in the J1 base. Separate the housing is left on the cable, the cable, the cable cannot be pulled out through the J1 axis piping. (Fig. 5.3.1 (a),(b)) Earth terminal in the J1 base Terminal on the battery box rear surface - + + ARP GB1 If there is the ARP, Connect the battery cable of the ARP cable, too. Housing Insert Cable J1 base Connector panel (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) - 166 - 5.REPLACING CABLES B 82235EN/08 Housing mounting bolt Insert Code pin, guide pin, guide bush or cross-recessed head machine screw Housing Remove the insert from the housing Remove the insert from the J1 connector Fig. 5.3.1 (b) Decomposition of the Harting connector - 167 - 5.REPLACING CABLES 4 B-82235EN/08 When the robot has limit switches (option), remove the terminal in the switch, then pull out the cast through hole. (Fig. 5.3.1 (c)) Limit switch Plate Plate Casting hole J1 base Terminal inside the limit switch Cable Fig. 5.3.1 (c) Replacing the J1-axis limit switch (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 5 6 When fan is mounted, remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") then remove fan cable and fan of J1/J2/J3-axis precautions that must be taken, see "Precautions to be observed when handling the Pulsecoder cable" at the beginning of Chapter 5. Remove the cover plate attached to the J2 base. If a DS/DP cable (option) is connected, remove the cover plate attached to the J2 base Cover plate Connector panel DS/DP cable (Option) Fig. 5.3.1 (d) J2 base right side 1 (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) - 168 - 5.REPLACING CABLES B-82235EN/08 7 The upper part of the J1-axis has a plate for clamping the cable. The plate is fastened to the J2 base. Remove the bolt and cable protection sheath attached to the plate, then drop the cable with the clamp in the pipe. (Fig. 5.3.1 (e)) J2 base Clamp Plate Fig. 5.3.1 (e) J2 base right side 2 (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 8 Remove and pull out the plate from within the J1 base as much as possible, then remove the bolt fastening the clamp. (Fig. 5.3.1 (e)) J2 base right side 2 (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 8 Remove and pull out the plate from within the J1 base as much as possible, then remove the bolt fastening the clamp. (Fig. 5.3.1 (f)) Clamp クランプ プレート Plate J1ベース J1 base Fig. 5.3.1 (f) Plate in the J1 base (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 9 Pull out the cable upward from the pipe of the J1-axis. - 169 - 5.REPLACING CABLES B-82235EN/08 10 Remove the bolts fastening the left plate of the J2 base, and pull out the cable to the lower side of the J2 arm by running the cable under the balancer. (Fig. 5.3.1 (g)) Plate $\mathcal{I} \cup -\mathcal{F}$ J2 base J2 $\mathcal{I} - \mathcal{F}$ J2 base J2 $\mathcal{I} - \mathcal{F}$ Fig. 5.3.1 (g) J2 base left side 1 (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 11 Remove the bolts fastening the plate of the J2 arm. (Fig. 5.3.1 (h)) Plate Cover plate J2 arm Fig. 5.3.1 (h) J2 arm (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 11 Remove the bolts fastening the plate of the J2 arm. (Fig. 5.3.1 (h)) Plate Cover plate J2 arm Fig. 5.3.1 (h) J2 arm (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 11 Remove the cover plate of the J2 arm. Then, remove the bolts fastening the plate of the J2 arm. (Fig. 5.3.1 (h)) Plate Cover plate J2 arm Fig. 5.3.1 (h) J2 arm (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 11 Remove the cover plate of the J2 arm. Then, remove the cover plate J2 arm Fig. 5.3.1 (h) J2 arm (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 11 Remove the cover plate of the J2 arm. Then, remove the cover plate of the J2 arm. Then, remove the cover plate J2 arm Fig. 5.3.1 (h) J2 arm (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 11 Remove the cover plate of the J2 arm. Then, remove the cover plate of the J2 arm. Then, remove the cover plate J2 arm Fig. 5.3.1 (h) J2 arm (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 11 Remove the cover plate of the J2 arm. Then, remove the cover plate J2 arm. Th 2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) - 170 - 5.REPLACING CABLES B-82235EN/08 If the robot has limit switches for the J2 arm. (Fig. 5.3.1 (i)) J3-axis limit swtch Casting hole Sponge for protection Sponge for protection Plate Casting hole Cover plate NC NO NC COM J2-axis limit switch (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) - 171 - 5.REPLACING CABLES B-82235EN/08 13 Remove the left plate B of the J3 casing. (Fig. 5.3.1 (j)) J3 casing 3ケーシング Plate A プレートA Plate B プレートA Fig. 5.3.1 (j) J3 casing left side (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 14 Remove the connector panel from the front of the J3 casing. (Fig. 5.3.1 (k)) J3 casing Connector panel Fig. 5.3.1 (k) J3 casing connector panel (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 14 Remove the connector panel from the front of the J3 casing. (Fig. 5.3.1 (k)) J3 casing Connector panel Fig. 5.3.1 (k) J3 casing connector panel (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 14 Remove the connector panel from the front of the J3 casing. (Fig. 5.3.1 (k) J3 casing Connector panel Fig. 5.3.1 (k) J3 casing connector panel from the front of the J3 casing. (Fig. 5.3.1 (k) J3 casing Connector panel Fig. 5.3.1 (k) J3 casing connector panel (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 14 Remove the connector panel from the front of the J3 casing. (Fig. 5.3.1 (k) J3 casing Connector panel Fig. 5.3.1 (k) J3 casing Connector panel from the front of the J3 casing. (Fig. 5.3.1 (k) J3 casing Connector panel Fig. 5.3.1 (k) J3 casing Connector panel (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 14 Remove the connector panel from the front of the J3 casing Connector panel (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 14 Remove the connector panel from the front of the J3 casing Connector panel (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 14 Remove the connector panel from the front of the J3 casing Connector panel from the front of the J3 casing Connector panel Fig. 5.3.1 (k) J3 casing Connector panel (R-2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) 14 Remove the connector panel from the front of the J3 casing Connector panel from the front of the J3 casing Connector panel (R-2000iB/165F/210F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250 2000iB/165F/210F/185L/250F/125L/175L/100H/150U/220U) - 172 - 5.REPLACING CABLES B-82235EN/08 15 Remove the right plate C of the J3 casing. Pull out the J3 to J6-axis motor cables with the plate through hole of the front side. (Fig. 5.3.1 (l).) J3 casing Plate C Fig. 5.3.1 (l) J3 casing right side (R-2000iB/165F/210F/185L/250F/125L/175L/150U/220U) 16 At last, remove the left plate A of the J3 casing. (See Fig. 5.3.1 (j).) This completes cable unit detachment from the cables, remove the clamp and cable protection sheaths from the cable unit. Next, cut the cable tie securing the cables, then detach the desired cable(s). (See Fig. 5.3.1 (m), (n).) M1M,M1P,M1BK M2M,M2P,M2BK,FAN J2OT Cable protection sheath J3OT To the connector panel Cable protection sheath Clamp M4M,M4BK,M4P M5M,M5BK,M5P M6M,M6BK,M6P ARM,ARP,AS I/O,EE M3M,M3BK,M3P Fig. 5.3.1 (m) Overview of cabling (R-2000iB/165F/210F/185L/250F/125L/175L/150U/220U) - 173 - 5.REPLACING CABLES B-82235EN/08 M1M,M1P,M1BK M2M,M2P,M2BK,FAN J2OT Cable protection sheath Clamp Clamp M4M,M4BK,M4P M5M,M5BK,M5P ARM,ARP,AS I/O,EE M3M,M3BK,M3P Fig. 5.3.1 (n) Overview of cabling (R 2000iB/100H) Assembling Install the cable according to the procedure below. 1 2 3 4 5 6 7 8 9 10 Fasten the cable unit to the J2 arm with the bolts. Don't be wrong the up and down. When a limit switch is used, run the cable through the cast through the cast through the cast through the cast through the switch is used. onto the plate of the J2 arm. Pull out any excess cable toward the back of the robot by running the cable under the balancer. Then, fasten the left plate of the J2 arm. (Fig. 5.3.1 (h), (i)) Pull out the cable toward the plate under the balancer. Be careful to lay the cable so that mechanical strain is not caused between the plate under the balancer and the cable. (Fig. 5.3.1 (j)) Run the J3 to J6 axis motor cables from the front of the J3 casing to the back side through the casting hole then attach plate C. (See Fig. 5.3.1 (j)) Run the J3 to J6 axis motor cables from the front of the J3 casing to the back side through the casting hole then attach plate C. (See Fig. 5.3.1 (j)) Run the J3 to J6 axis motor cables from the front of the J3 casing to the back side through the casting hole then attach plate C. (See Fig. 5.3.1 (j)) Run the J3 to J6 axis motor cables from the front of the J3 casing to the back side through the casting hole then attach plate C. (See Fig. 5.3.1 (j)) Run the J3 to J6 axis motor cables from the front of the J3 casing to the back side through the casting hole then attach plate C. (See Fig. 5.3.1 (j)) Run the J3 to J6 axis motor cables from the front of the J3 casing to the back side through the casting hole then attach plate C. (See Fig. 5.3.1 (j)) Run the J3 to J6 axis motor cables from the front of the J3 casing to the back side through the casting hole 5.3.1 (l).) Accommodate any excessive cables in the J3 casing and secure the connector panel on the front of the J1 casing. (See Fig. 5.3.1 (k).) Finally, retain the cable through the J1 casing and secure the connector panel on the front of the J3 casing. (See Fig. 5.3.1 (k).) Finally, retain the cable through the J1 casing and secure the connector panel on the front of the J3 casing. plate in the J1 base. Bind tightly the cables with a thick cable tie (Approx. W: 7.6mm) running through the clamp, then fasten the plate at the top of the J1-axis. Bind tightly the cables with a thick cable tie (Approx. W: 7.6mm) running through the clamp, then fasten the plate to the J2 base. (Fig. 5.3.1 (e)) Fasten the connector panel together with the cover plate to the J2 base. If a DS/DP cable (option) is used, fasten the connector covers are attached to the J1-axis and J2-axis motors. When fan is mounted, remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") When the cable through the cast through the switch to the plate on the J1/J2/J3-axis. base. (Fig. 5.3.1 (c)) When the robot has limit switches (option), insert limit switch cable to No.30 and No.37 holes of RP connector back side. If they are not attached, insert limit switch cable to No.30 and No.37 holes of RP connector back side. If they are not attached, insert limit switch cable to No.30 and No.37 holes of RP connector back side. If they are not attached, insert limit switch cable to No.30 and No.37 holes of RP connector back side. If they are not attached, insert limit switch cable to No.30 and No.37 holes of RP connector back side. switch cable or Short circuit wire (Photo is a short circuit wire) RP1 connector Fig. 5.3.1 (o) Insertion of the limit switch cables and tubes to the connector panel on the back of the robot. Connect the earth terminal to the J1 base, then connect the battery terminal to the battery box. Next, fasten the connector panel to the J1 base, then connect the robot connection cable to the connector panel. (Fig. 5.3.1 (a)) Turn on the controller power. If an alarm is issued at this time, release it according to Section 6.2. Perform quick mastering referring Section 8.4, 8.5 of the Operator's manual. - 175 - 5.REPLACING CABLES 5.3.2 B-82235EN/08 Replacement Procedure (R-2000iB/165R/200R/100P) Remove Remove the cables as the following procedure. 1 Set the Quick Master Reference Position referring to Section 8.4,8.5 of the Operator's Manual. (All the axes are set to 0^o before shipment.) 2 Place all the robot axes in their 0-degree position, then turn off the controller power. 3 Detach the cable leading to the controller from the connector panel on the rear of the battery box and the earth terminal in the J1 base, then detach all the connector panel. Remove the terminal on the rear of the HARTING connector from each other.; If the housing is left on the cable cannot be pulled out through the J1 axis piping. (Fig. 5.3.2 (a), (b)) Earth terminal in the J1 base Fig. 5.3.2 (a), (b)) Earth terminal on the battery box rear surface - + + ARP GB1 If there is the ARP, Connect the battery cable of the ARP cable, too. Housing Insert Cable Connector panel J1 base Fig. 5.3.2 (a) J1 connector panel (R-2000iB/165R/200R/100P) - 176 - Robot connection cable 5.REPLACING CABLES B-82235EN/08 Housing mounting bolt Insert from the housing Remove the insert from the J1 connector plate Remove the insert from the housing Remove the insert from the housing Remove the insert from the J1 connector plate Remove the Remove the I1 connector plate the housing and the connector plate hole, then remove the cable from the J1 connector Fig. 5.3.2 (b) Decomposition of the Harting connector, 177 - 5.REPLACING CABLES 4 B-82235EN/08 When the robot has limit switches (option), remove the limit switches (option), remove the limit switch for the J1-axis from the J1 base, and remove the terminal in the switch, then pull out the cable from the cast through hole. (Fig. 5.3.2 (c)) Limit switch Plate Plate Casting hole Terminal inside the limit switch J1 base Cable Fig. 5.3.2 (c) J1-axis limit switch (R-2000iB/165R/200R/100P) 5 6 When fan is mounted, remove fan cable and fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") Remove all connectors from the J1axis through J6-axis motors. For the precautions to be observed when handling the Pulsecoder cable" at the beginning of Chapter 5. Remove the cover plate attached to the J2 base. If a DS/DP cable (option) is connected, remove the cable from the connector panel jointly secured to the cover plate. (Fig. 5.3.2 (d)) J2 base Cover plate DS/DP cable (option) Connector panel Fig. 5.3.2 (d) J2 base right side 3 (R-2000iB/165R/200R/100P) - 178 - 5.REPLACING CABLES B-82235EN/08 7 The upper part of the J1-axis has a plate for clamping the cable. The plate is fastened to the plate, then drop the cable with the clamp in the pipe. (Fig. 5.3.2 (e)) Clamp J2 base Plate Fig. 5.3.2 (e) 8 J2 base right side 4 (R-2000iB/165R/200R/100P) Remove and pull out the plate from within the J1 base Fig. 5.3.2 (f) Plate in the J1 base (R-2000iB/165R/200R/100P) Remove and pull out the plate from within the J1 base Fig. 5.3.2 (f) Plate in the J1 base (R-2000iB/165R/200R/100P) Remove and pull out the plate from within the J1 base Fig. 5.3.2 (f) Plate in the J1 base Fig. 5.3.2 (f) Plate Plate P 2000iB/165R/200R/100P) 9 Pull out the cable upward from the pipe of the J1-axis. - 179 - 5.REPLACING CABLES B-82235EN/08 10 Remove the bolts fastening the left plate of the J2 base Fig. 5.3.2 (g) J2 base left side 2 (R-2000iB/165R/200R/100P) 11 Remove the cover plate of the J2 arm. Then, remove the bolts fastening the plate of the J2 arm. (Fig 5.3.2 (h) J2 arm (R-2000iB/165R/200R/100P) - 180 - 5.REPLACING CABLES B-82235EN/08 If the robot has limit switches (option), remove the limit switches for the J2-axis and J3-axis from the plate of the J2 arm, and remove the terminals in the switches, then pull out the cables from the cast through hole of the J2 arm. (Fig. 5.3.2 (i)) J3-axis limit switch Casting hole Sponge for protection Plate Plate Casting hole Cover plate NC NO NC COM J2-axis limit switch COM 12 Terminals inside the limit switch Fig. 5.3.2 (i) J2/J3-axis limit switch (R-2000iB/165R/200R/100P) - 181 - 5.REPLACING CABLES B-82235EN/08 13 Remove the left plate B of the J3 casing left side (R-2000iB/165R/200R/100P) 14 Remove the connector panel from the front of the J3 casing. (Fig. 5.3.2 (j) J3 casing left side (R-2000iB/165R/200R/100P) 14 Remove the left plate B プレートB Fig. 5.3.2 (j) J3 casing left side (R-2000iB/165R/200R/100P) - 181 - 5.REPLACING CABLES B-82235EN/08 13 Remove the left plate B プレートB Fig. 5.3.2 (j) J3 casing left side (R-2000iB/165R/200R/100P) - 181 - 5.REPLACING CABLES B-82235EN/08 13 Remove the left plate B プレートB Fig. 5.3.2 (j) J3 casing left side (R-2000iB/165R/200R/100P) - 181 - 5.REPLACING CABLES B-82235EN/08 13 Remove the left plate B プレートB Fig. 5.3.2 (j) J3 casing left side (R-2000iB/165R/200R/100P) - 181 - 5.REPLACING CABLES B-82235EN/08 13 Remove the left plate B プレートB Fig. 5.3.2 (j) J3 casing left side (R-2000iB/165R/200R/100P) - 181 - 5.REPLACING CABLES B-82235EN/08 13 Remove the left plate B プレートB Fig. 5.3.2 (j) J3 casing left side (R-2000iB/165R/200R/100P) - 181 - 5.REPLACING CABLES B-82235EN/08 13 Remove the left plate B プレートA Plate B プレートB Fig. 5.3.2 (j) J3 casing left side (R-2000iB/165R/200R/100P) - 181 - 5.REPLACING CABLES B-82235EN/08 13 Remove the left plate B プレートA Plate B プレートB Fig. 5.3.2 (j) J3 casing left side (R-2000iB/165R/200R/100P) - 181 - 5.REPLACING CABLES B-82235EN/08 13 Remove the left plate B プレートA Plate 5.3.2 (k) J3 casing Connector panel Fig. 5.3.2 (k) J3 casing connector panel (R-2000iB/165R/200R/100P) - 182 - 5.REPLACING CABLES B-82235EN/08 15 Remove the right plate C Fig. 5.3.2 (l). J3 casing right side (R-2000iB/165R/200R/100P) 16 At last, remove the left plate A of the J3 casing. (See Fig. 5.3.2 (j).) This completes cable unit detachment from the cables, remove the clamp and cable protection sheath from the cable unit. Next, cut the cables, then detach the desired cable(s). (See Fig. 5.3.2 (m).) M2M,M2P,M2BK,FAN M1M,M1P,M1BK J2OT J3OT Cable protection sheath To the connector panel Cable protection sheath To Assembling Install the cable according to the procedure below. 1 2 3 4 5 6 7 8 9 10 Fasten the cable unit to the J2 arm with the bolts. Don't be wrong the up and down. When a limit switch is used, run the cable through the cast through the cast through the cast through the cast through the switch onto the plateau of the J2 arm with the bolts. of the J2 arm. Pull out any excess cable toward the J2 arm cover, then bind the excess cable with the main cable by using a cable tie. Next, install the cover plate on the J2 arm. (Fig. 5.3.2 (h), (i)) Pull out the cable under the balancer. Then, fasten the left plate of the J2 arm cover, then bind the excess cable toward the plate under the back of the robot by running the cable under the balancer. Then, fasten the left plate of the J2 arm cover, then bind the excess cable toward the plate under the balancer. balancer. Be careful to lay the cable so that mechanical strain is not caused between the plate under the balancer and the cable. (Fig. 5.3.2 (j)) Run the J3 to J6 axis motor cables from the front of the J3 casing to the back side through the casting hole then attach plate C. (See Fig. 5.3.2 (l).) Accommodate any excessive cables in the J3 casing and secure the connector panel on the front of the J1 casing. (See Fig. 5.3.2 (j).) Run the cable through the J1-axis pipe from the top of the J2 base, then pull out the cables with plate B. (See Fig. 5.3.2 (j).) Run the cable through the J1-axis pipe from the top of the J2 base, then pull out the cable through the J1-axis pipe from the top of the J2 base. Fasten the cables with plate B. (See Fig. 5.3.2 (j).) Run the cable through the J1-axis pipe from the top of the J2 base. Fasten the cables with plate B. (See Fig. 5.3.2 (j).) Run the cables with plate B. (See J1 base. Bind tightly the cables with a thick cable tie (Approx. W: 7.6mm) running through the clamp, then fasten the plate to the J1 base. (Fig. 5.3.2 (f)) Fasten the top of the J1-axis. Bind tightly the cables with a thick cable tie Approx. (W: 7.6mm) running through the clamp, then fasten the plate to the plate to the J1 base. the J2 base. (Fig. 5.3 (i)) Fasten the connector panel together with the cover plate to the J1-axis through J6-axis motors. Make sure that the Pulsecoder connector covers are attached to the J1-axis through J6-axis motors. Make sure that the Pulsecoder connector covers are attached to the J1-axis through J6-axis motors. Make sure that the Pulsecoder connector covers are attached to the J1-axis through J6-axis motors. axis and J2-axis motors. When fan was mounted, mount fan of J1/J2/J3-axis. (See Section 4.7 "REPLACING THE FANS") When the robot has limit switches (option), run the cable to the terminal in the switch. Next, fasten the switch to the plate on the J1 base. (Fig. 5.3.2) (c)) When the robot has limit switches (option), insert limit switch cable to No.30 and No.37 holes of RP connector back side. If they are not attached, inserted and it is not retracted. (Fig. 5.3.2 (n)) Limit switch cable or Short circuit wire (Photo is a short circuit wire) RP1 connector Fig. 5.3.2 (n) Insertion of the limit switch cable or the short circuit wire - 184 - 5.REPLACING CABLES B-82235EN/08 11 12 13 Connect the earth terminal to the J1 base, then connect the battery terminal to the battery box. Next, fasten the connector panel to the J1 base, then connect the robot connection cable to the connector panel. Turn on the controller power. If an alarm is issued at this time, release it according to Section 6.2. Perform quick mastering referring Section 8.4 ,8.5 of the Operator's manual. 5.3.3 Replacement Procedure (R-2000iB/170CF) Remove the cables as the following procedure. 1 Set the Quick Master Reference Position referring to Section 8.4,8.5 of the Operator's Manual. (All the axes are set to 0^o before shipment.) 2 Place all the robot axes in their 0-degree position, then turn off the controller power. 3 Detach the cable leading to the controller from the connector panel on the rear of the robot. Remove the connector panel from the J1 base, then detach all the cable and air tubes from the connector panel. Remove the terminal on the rear of the HARTING connector from each other.; If the housing is left on the cable, the cable cannot be pulled out through the J1 axis piping. (Fig. 5.3.3 (a), (b)) Earth terminal in the J1 base Terminal on the battery box rear surface - + + ARP GB1 If there is the ARP, Connector panel (R-2000iB/170CF) - 185 - Robot connection cable 5.REPLACING CABLES B-82235EN/08 Housing mounting bolt Insert Code pin, guide bush or cross-recessed head machine screw Housing Remove the housing Remove the housing and the connector plate hole, then remove the cable from the J1 connector Fig. 5.3.3 (b) Decomposition of the Harting connector 4 When the robot has limit switches (option), remove the limit switch for the J1 base, and remove the terminal in the switch, then pull out the cable from the cast through hole. (Fig. 5.3.3 (c)) Limit switch Plate Plate Casting hole J1 base Terminal inside the limit switch Cable Fig. 5.3.3 (c) J1-axis limit switch (R-2000iB/170CF) - 186 - 5.REPLACING CABLES B-82235EN/08 5 6 Remove connectors from the J1-axis through J3-axis motors. For the precautions that must be taken, see "Precautions to be observed when handling the Pulsecoder cable" at the beginning of Chapter 5. The upper part and the side of the J1-axis has a plate for clamping the cable. The plate is fastened to the J2 base. Remove the connector panel, then remove the connector panel, then remove the cable from the cable with the clamp in the pipe. (Fig. 5.3.3 (d)) Bolt M6X10(4) Plate Bolt M8X12(4) Plate Bolt M8X12(2) DS/DP cable (option) Connector plate Fig. 5.3.3 (d) J2 base (R-2000iB/170CF) 7 Remove and pull out the plate from within the J1 base as much as possible, then remove the bolt fastening the clamp. (Fig. 5.3.3 (e)) Clamp クランプ プレート Plate J1ベース J1 base Fig. 5.3.3 (e) Plate in the J1 base (R-2000iB/170CF) 7 Remove and pull out the plate from within the J1 base as much as possible, then remove the bolt fastening the clamp. (Fig. 5.3.3 (e)) Clamp クランプ プレート Plate J1ベース J1 base Fig. 5.3.3 (e) Plate in the J1 base (R-2000iB/170CF) 7 Remove and pull out the plate from within the J1 base as much as possible, then remove the bolt fastening the clamp. (Fig. 5.3.3 (e)) Clamp クランプ プレート Plate J1ベース J1 base Fig. 5.3.3 (e) Plate in the J1 base (R-2000iB/170CF) 7 Remove and pull out the plate from within the J1 base as much as possible, then remove the bolt fastening the clamp. (Fig. 5.3.3 (e)) Clamp クランプ プレート Plate J1ベース J1 base Fig. 5.3.3 (e) Plate in the J1 base (R-2000iB/170CF) 7 Remove and pull out the plate from within the J1 base Fig. 5.3.3 (e) Plate in the J1 base (R-2000iB/170CF) 7 Remove and pull out the plate from within the J1 base Fig. 5.3.3 (e) Plate Fi 8 Pull out the cable upward from the pipe of the J1-axis. - 187 - 5.REPLACING CABLES B-82235EN/08 9 Remove the bolts fastening the cover, then J2 arm, the J3 arm, remove the cover. (Fig. 5.3.3 (g)) Plate Bolt M6X10(4) Cover Bolt M6X10(2) Fig. 5.3.3 (g) J3 casing connector panel (R-2000iB/170CF) - 188 - 5.REPLACING CABLES B-82235EN/08 11 12 13 14 Remove the bolt (M6x10, 2pcs) and connector panel. Remove the bolt (M6x10, 2pcs) and connector panel Bolt M6X10(2) Fig. 5.3.3 (g) J3 casing connector panel (R-2000iB/170CF) - 188 - 5.REPLACING CABLES B-82235EN/08 11 12 13 14 Remove the bolt (M6x10, 2pcs) and connector panel). precautions that must be taken, see "Precautions to be observed when handling the Pulsecoder cable" at the beginning of Chapter 5. Remove the plate. Remove the plate. Remove the plate (M6x10, 4pcs), then remove the plate. Remove the plate. art of the cables, remove the clamp and cable protection sheath from the cable unit. Next, cut the cable tie securing the cables, then detach the desired cables, then detach the desired cable (s). (See Fig. 5.3 .3 (h).) A ARP, ARM, AS, I/O, DS, DP, EE Cable protection sheath M4M, M4P, M4BK M5M, M5P, M5BK M6M, M6P, M6BK Clamp M1M, M1P, M1BK, M2M, M2P, M2BK M3M, M3P, M3BK VIEW A Fig. 5.3.3 (h) Overview of cabling (R-2000iB/170CF) - 189 - 5.REPLACING CABLES B-82235EN/08 Assembling Install the cable unit to the J2 arm with the bolts. Don't be wrong the up and down. (Fig. 5.3.3 (f)) Pull out the cable toward the back of the robot. Then, fasten the side of the J2 base with the bolt (M8x12, 2pcs). (Fig. 5.3.3 (d)) Twist in this direction 180 degree and install the connector panel, then mount the connector panel on J2 base. (Fig. 5.3.3 (d)) Twist in this direction 180 degrees. Fig. 5.3.3 (i) Attachment of J2 arm (R-2000iB/170CF) 3 4 5 6 7 Mount the bolt (M6x10, 4pcs). Attach connectors to the J4-axis through J6-axis motors. Attach the cable and the air tube to the connector panel, then mount the connector panel on J3-casing with the bolts (M6x10, 2pcs). Finally, mount the cover on the plate with the bolts (M6x10, 4pcs). Attach connector covers Run the cable through J3-axis motor, then mount the cable toward the back of the J1 base. Fasten the clamp onto the plate in the J1 base. Bind tightly the cables with a thick cable tie (Approx. W: 7.6mm) running through the clamp, then fasten the plate at the top of the J1-axis. Bind tightly the cables with a thick cable to the J2 base. (Fig. 5.3.3 (d)) When the robot has limit switches (option), run the cable to the plate on the J1 base. (Fig. 5.3.3 (d)) When the robot has limit switches (option), run the cable to the plate on the J1 base. (Fig. 5.3.3 (c)) When the robot has limit switches (option), insert limit switch cable or Short circuit wire (Photo is a short circuit wire instead. Press pin from opposite side and to is not retracted. (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire (Photo is a short circuit wire instead.) (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire instead. (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire (Photo is a short circuit wire instead.) (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire (Photo is a short circuit wire instead.) (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire instead.) (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire (Photo is a short circuit wire instead.) (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire (Photo is a short circuit wire instead.) (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire (Photo is a short circuit wire instead.) (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire (Photo is a short circuit wire instead.) (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire (Photo is a short circuit wire instead.) (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire (Photo is a short circuit wire instead.) (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire (Photo is a short circuit wire instead.) (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire (Photo is a short circuit wire instead.) (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire (Photo is a short circuit wire instead.) (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire (Photo is a short circuit wire instead.) (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire (Photo is a short circuit wire instead.) (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire (Photo is a short circuit wire instead.) (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire (Photo is a short circuit wire instead.) (Fig. 5.3.3 (h)) Limit switch cable or Short circuit wire (Photo is a short circuit wire instead.) (Fig. 5.3.3 (h)) (Fig. 5. wire) RP1 connector Fig. 5.3.3 (j) Insertion of the limit switch cable or the short circuit wire 11 12 13 Connect the cables and tubes to the connect the battery terminal to the J1 base, then connect the connect the battery back. Next, fasten the connector panel to the J1 base, then connect the cables and tubes to the connect the battery back. the robot connection cable to the connector panel. (Fig. 5.3.3 (a)) Turn on the controller power. If an alarm is issued at this time, release it according to Section 8.4, 8.5 of the Operator's manual. - 191 - 5.REPLACING CABLES 5.3.4 B-82235EN/08 Replacement Procedure (R-2000iB/210WE) Remove Remove the cables as the following procedure. 1 Set the Quick Master Reference Position referring to Section 8.4,8.5 of the Operator's Manual. (All the axes are set to 0° before shipment.) 2 Place all the robot axes in their 0-degree position, then turn off the controller power. 3 Remove the cover plate of J1 base side battery storage box. Remove battery box cover and remove battery storage box. Remove battery storage box side and pull it out from box. Remove the battery storage box side and pull it out from box. Remove air tube (blue, outside diameter 6mm) from joint and remove cable grand from battery storage box side and pull it out from box. box. (Fig. 5.3.4 (a)) Terminals on the battery box rear surface Cable grand + Battery cable (GB1) - - + nut part A part B J1 base Air tube (blue, Outside diameter 6mm) (Cable grand) (Battery box cover Bolt M4X10 Cover plate Gasket A290-7329-Z224 Fig. 5.3.4 (a) J1 connector panel (R-2000iB/210WE) 4 Remove connector box cover of robot back side, then remove connector box from J1 base. Remove all tubes from connector box back side and pull out cables from connector box. (Fig. 5.3.4 (b)) - 192 - 5.REPLACING CABLES B-82235EN/08 J1ベース内部のアース端子 Earth terminal in the J1 base Coupling of connector box rear side 分線ボックス背面の継手 Bolt ボルト M6X10 (12) カバー Cover Gasket ガスケット A290-7329-X227 Bolt ボルト M4X10 (16) Gasket ガスケット A290-7329-X227 Bolt ボルト M4X10 (16) Gasket ガスケット A290-7329-X227 Bolt ボルト M6X10 (12) カバー Cover Gasket ガスケット A290-7329-X227 Bolt ボルト M4X10 (16) Gasket ガスケット A290-7329-X227 Bolt ボルト M6X10 (12) カバー Cover Gasket ガスケット A290-7329-X227 Bolt ボルト M4X10 (16) Gasket ガスケット A290-7329-X227 Bolt ボルト M6X10 (12) カバー Cover Gasket ガスケット A290-7329-X227 Bolt ボルト M4X10 (16) Gasket ガスケット A290-7329-X227 Bolt ボルト M6X10 (12) カバー Cover Gasket ガスケット A290-7329-X227 Bolt ボルト M6X10 (16) Gasket ガスケット A290-7329-X227 Bolt ボルト M6X10 (12) カバー Cover Gasket ガスケット A290-7329-X227 Bolt ボルト M6X10 (16) Gasket ガスケット A290-7329-X227 Bolt ボルト M6X10 (17) Gasket ガ 7329-X223 A290-7329-X223 ボルト Bolt M4X10(8) (8) M4x10 RPケーブル側 RP cable Round 丸い板金 J1 base J1ベース Cable ケーブル board 制御装置の接続ケーブル Robot connector panel (R-2000iB/210WE) Housing mounting bolt Insert Code pin, guide pin, guide bush or crossrecessed head machine screw Housing Remove the housing from the J1 connector plate Remove the insert from the housing Remove the insert from the J1 connector plate Remove the insert from the J1 connector plate Remove the insert from the housing Remove the insert from the J1 connector plate Remove the insert from the housing Remove the insert from the J1 connector plate Remove the insert from the housing Remove the insert from the housing Remove the insert from the J1 connector plate Remove the insert from the housing Remove the insert from the J1 connector plate Remove the insert from the housing Remove 82235EN/08 Remove the cover plate attached to the J2 base. (Fig. 5.3.4 (d)) J2 base J2ベース Cover plate カバープレート Fig. 5.3.4 (d) J1 connector panel (R-2000iB/210WE) 6 The upper part of the J1-axis has a plate for clamping the cable. The plate is fastened to the J2 base. Remove the bolt and cable protection sheath attached to the plate, then drop the cable with the clamp in the pipe. (Fig. 5.3.4 (e)) J2 base Clamp Plate Fig. 5.3.4 (e) J2 base right side (R-2000iB/210WE) - 194 - 5.REPLACING CABLES B-82235EN/08 7 Remove and pull out the plate from within the J1 base as much as possible, then remove the bolt fastening the clamp. (Fig. 5.3.4 (f)) Clamp クランプ プレート Plate J1ベース J1 base Fig. 5.3.4 (f) Plate in the J1 base (R-2000iB/210WE) 8 Pull out the cable upward from the pipe of the J1-axis. 9 Remove air tube (blue, outside diameter 12mm) which is diverged from cable bunch and connected to joint. (Fig. 5.3.4 (g)) Air tube (blue, outside diameter 12mm) which is diverged from the pipe of the J1-axis. 9 Remove air tube (blue, outside diameter 12mm) which is diverged from cable bunch and connected to joint from joint. (Fig. 5.3.4 (g)) Air tube (blue, outside diameter 12mm) which is diverged from cable bunch and connected to joint from joint. CABLES 10 B-82235EN/08 Remove the bolts fastening the left plate of the J2 base, and pull out the cable to the lower side of the J2 arm by running the cable to the bolts fastening the left plate of the J2 arm by running the cable to the bolts fastening the side 1 (R-2000iB/210WE) 11 Remove the bolts fastening the cable to the bo the plate of the J2 arm. (Fig. 5.3.4 (i)) Plate Cover plate J2 arm Fig. 5.3.4 (i) J2 arm (R-2000iB/210WE) - 196 - 5.REPLACING CABLES B-82235EN/08 12 Remove the left plate B of the J3 casing 3ケーシング Plate A プレートA Plate B プレートB Fig. 5.3.4 (j) J3 casing left side (R-2000iB/210WE) 13 Remove the connector panel from the front of the J3 casing. (Fig. 5.3.4 (k)) J3 casing Connector panel Fig. 5.3.4 (k) J3 casing connector panel (R-2000iB/210WE) - 197 - 5.REPLACING CABLES 14 B-82235EN/08 Remove the right plate C fig. 5.3.4 (l) J3 casing Plate C Fig. 5.3.4 (l) J3 casing Plate C Fig. 5.3.4 (l) J3 casing Connector panel (R-2000iB/210WE) - 197 - 5.REPLACING CABLES 14 B-82235EN/08 Remove the right plate C fig. 5.3.4 (l) J3 casing Plate C Fig. 5. casing right side (R-2000iB/210WE) 15 At last, remove the left plate A of the J3 casing. (See Fig. 5.3.4 (j).) This completes cable unit detachment from the cables, remove the clamp and cable protection sheath from the cables, remove the clamp and cable (S). (See Fig. 5.3.4 (m).) M1M,M1P,M1BK M2M,M2P,M2BK,FAN J2OT Cable protection sheath J3OT To the connector panel Cable protection sheath Clamp Clamp M4M,M3BK,M3P Fig. 5.3.4 (m) Overview of cabling (R-2000iB/210WE) - 198 - 5.REPLACING CABLES B-82235EN/08 Assembling 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 Fasten the cable unit to the J2 arm. (Fig. 5.3.4 (ii)) Pull out the cable toward the back of the robot by running the cable under the balancer. Then, fasten the left plate of the J2 base and the plate under the balancer. Be careful to lay the cable so that mechanical strain is not caused between the plate under the balancer and the cable. (Fig. 5.3.4 (i)) Run the J3 to J6 axis motor cables from the front of the J3 casing to the back side through the casting hole then attach plate C. (See Fig. 5.3.4 (k).) Accommodate any excessive cables in the J3 casing and secure the connector panel on the front of the J3 casing. (See Fig. 5.3.4 (j).) Finally, retain the cables with plate B. (See F Fasten the clamp onto the plate in the J1 base. Bind tightly the cables with a thick cable tie (Approx. W: 7.6mm) running through the clamp, then fasten the plate to the J1 base. (Fig. 5.3.4 (f)) Fix the fan-shaped cable protection sheath to the cable bunch, so that it is hidden in the pipe hole (Fig. 5.3 (g)). Let cable bunch comply with J2 base side, then fix the cover plate. In this time, be careful not to pick up cables with the plate. Connect J2 base back side air tube (blue, outside diameter 12mm) to joint well. (Fig. 5.3.4 (g)) Attach all connectors to the J1-axis through J6-axis motors. Attach Pulsecoder connector covers to J1/J2 -axis motors. Return battery cable (cable with GB1 tag) from cables pulled out to robot back side to inside of J1 base, then pull them to J1 base side. Loosen cable grand which is temporally tightened to battery cable. Put battery cable to battery storage box inside. insert nut part A which is removed some time ago to battery cable grand, tighten nut part A and fix cable grand to battery storage box. In this time, do not tighten part B of cable grand completely. In this time, be careful to polarity of +/-. Fix battery box to battery storage box, then attach gasket 1 of the new article and cover plate with bolt 2. Connect air tube (blue, outside diameter 6mm) to battery cables to back side to prevent interference of cables/air tubes and [1-axis movable part cable bunch, then fix excess cables/air tubes to cable bunch with cable ties. Insert gasket A290-7329-X227 of the new article to cables which are pulled out to robot back side, insert them from specified hole of connector box to inside. Sandwich gasket between round plate and connector box and fix them with seal bolts M4X10. In this time, RM cable (Connector is bigger.) is outside hole, RP cable (Connector is smaller.) is inside hole. Fix connector box with seal bolts M4X10, then bundle rubber tube to connector box back side joint, then connect earth terminal to J1 base. When you would like to replace air tubes inside connector box, replace them in this time. Fix connector box with seal bolts M6X10. (Fig. 5.3.4 (b)) Connect the robot connector box, then turn on the controller power. Turn on the controller power. If an alarm is issued at this time, release it according to Section 6.2. Perform guick mastering referring Section 8.4, 8.5 of the Operator's manual. - 199 - 5.REPLACING CABLES 5.3.5 B-82235EN/08 Replacement Procedure (R-2000iB/165CF) Remove the cables as the following procedure. 1 Set the Quick Master Reference Position referring to Section 8.4 of the Operator's Manual. (All the axes are set to 0^o before shipment.) 2 Place all the robot axes in their 0-degree position, then turn off the controller from the connector panel on the rear of the robot. Remove the connector panel from the J1 base, then detach all the cable and air tubes from the connector panel. Remove the terminal on the rear of the battery box and the earth terminal in the J1 base. Separate the housing and insert of the battery box and the earth terminal in the J1 base. piping, (Fig. 5.3.5 (a), (b)) Ground terminal in the 11 base VIEW A Battery box VIEW B Terminals on the battery box rear surface Fig. 5.3.5 (a) 11 connector panel (R-2000iB/165CF) - 200 - 5.REPLACING CABLES B-82235EN/08 Housing mounting bolt Insert Code pin, guide bush or cross-recessed head machine screw Housing Remove the housing from the J1 connector plate hole, then remove the connector Fig. 5.3.5 (b) Decomposition of the Harting connector 4 5 6 7 8 Remove the connector plate hole, then remove the connector Fig. 5.3.5 (b) Decomposition of the Harting connector plate hole, then remove the connector plate hole, then remove the connector plate hole, then remove the connector Fig. 5.3.5 (b) Decomposition of the Harting connector Plate hole, then remove the connector connector and tube. When the robot has limit switches (option), remove the limit switch for the J1-axis from the glate of the J1 base, and remove all connectors from the j1-axis through J6-axis motors. For the precautions that must be taken, see "Precautions to be observed when handling the Pulsecoder cable" at the beginning of Chapter 6. When the DS/DP cable (optional) is connected, remove the connector fixed on the J2 base. (Fig. 5.3.5 (c)) The upper part of the J1-axis has a plate for clamping the cable. The plate is fastened to the J2 base. Remove the bolt and cable protection sheath attached to the plate, then drop the cable with the clamp in the pipe. (Fig. 5.3.5 (d)) - 201 - 5.REPLACING CABLES B-82235EN/08 Cable tie Fig. 5.3.5 (c) J2 base right side (R-2000iB/165CF) 9 Remove and pull out the plate from within the J1 base as much as possible, then remove the bolt fastening the clamp. (Fig. 5.3.5 (d)) Clamp Plate J1 base Fig. 5.3.5 (d) Plate in the J1 base (R-2000iB/165CF) 10 Pull out the cable upward from the plate that fixes the plate to the left of the J2 base and pull it out of the J2 base. (Fig. 5.3.5 (e)) 12 Remove the plate that fixes the cable to the J2 arm. (Fig. 5.3.5 (e)) 13 If the robot has limit switches (option), remove the limit switches for the J2-axis from the cables from the cable from the cable of the J2 arm. (Fig. 5.3.5 (e)) J3-axis limit switch (optional) J2 arm Cable fixation plate J2 base J2-axis limit switch (optional) Cable fixation plate Fig. 5.3.5 (e) Replacing cables (R-2000iB/165CF) - 203 - 5.REPLACING CABLES B-82235EN/08 14 Remove the bolt that fixes the plate to the left of the J3 casing. (Fig. 5.3.5 (f) J3 casing left side (R-2000iB/165CF) - 204 - 5.REPLACING CABLES B-82235EN/08 15 Remove the connector box at the right front of the J3 casing and then remove the cables and tubes from the connector box. (Fig. 5.3.5 (g) J3 casing connector panel Plate Fig. 5.3.5 (g) J3 casing connector panel (R-2000iB/165CF) - 205 - 5.REPLACING CABLES 16 B-82235EN/08 To replace part of the cables, remove the clamp and cable protection sheath from the cable unit. Then, cut the cable to be replaced and then remove the cable. (Fig. 5.3.5 (h)) Clamp Clamp Cable protection sheath To the J3-axis and wrist motor To the connector panel All cables are bundled by two cable ties T1201 and loosely attached. Fig. 5.3.5 (h) Overview of cabling (R-2000iB/165CF) Assembling 1 2 3 4 5 6 7 8 9 10 11 12 13 14 Before attaching the cables to be the robot, bundle the cables with cable ties at marking positions and attach the clamps and cable protection sheaths. (Fig. 5.3.5 (h)) Fix the cable unit to the J2 arm with bolts. When the limit switch is attached, pass the cables through the mold hole of the J2 arm, connect the switch terminals for the J2 axis, and attach the switch to the plate of the J2 arm. (Fig. 5.3.5 (e)) Fix the plate to the left of the J2 arm. Connect the cable and tube to the connector box on the right side of the J3 casing and then fix the connector box to the J2 base to the J1 base. (Fig. 5.3.5 (f) and (g)) Pass the cable from above the J1 base. (Fig. 5.3.5 (d)) Fix the plate to the J2 base on the

upper side of the J1-axis. (Fig. 5.3.5 (c)) When the DS/DP cable (optional) is attached, fix the connector panel and then fix the connector panel and then fix the connector panel to the J2 base. Connect the cables to the terminals in the switch. Fix the switch to the plate on the J1 base. Connect the cables and tubes to the connector panel on the back of the robot. Connect the earth terminal to the J1 base and connect the back of the battery box. Fix the connector panel to the J1 base and connect the robot connection cable to the connector panel. (Fig. 5.3.5 (a)) Turn on the controller power. Clear the alarm that occurs at this time as described in Section 6.2. Perform quick mastering referring Section 8.4 ,8.5 of the Operator's manual. - 206 - 5.REPLACING CABLES B-82235EN/08 5.4 LIMIT SWITCH REPLACEMENT (OPTION) This section explains how to replace limit switches. See the cable replacement procedure for an explanation of how to detach the limit switch. Refer to OPERATOR'S MANUAL (B-82234EN) about the adjustment of the limit switch. (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/125L/175L/100H/150U /220U) 1. J1-axis limit switch from the plate on the J1 base. Cut the cable from the plate on the plate on the J1 base. Cut the cable from the plate on the remove the limit switch from the cable. Attach a new limit switch to the cable. Install the limit switch on the plate of the J2 arm used to prevent the limit switch cable from slackening. Remove the plate of the J2 arm used to fasten the limit switch. Remove the limit switch from the plate. Remove the terminal in the switch, then remove the limit switch on the plate. Install the plate on the J2 arm. Pull the limit switch cable slackening in the J2 arm. to the cables for the mechanical section. 2 3 4 5 6 7 8 CAUTION 1 If a cable is slackening, the cable can rub against the casting and can break as the robot moves. Ensure that the cable does not slacken to rub against the casting and the casting and the casting and the casting and can break as the robot moves. is small, sponge covers are wound for protection. When securing the cable, make sure that the sponge covers are placed near the casting shown in the figure. 3 For R-2000iB/170CF, J2/J3-axis limit switches. (See the OPERATOR'S MANUAL.) - 207 - 5.REPLACING CABLES B-82235EN/08 (R-2000iB/165CF) 3. J2-axis limit switch to the cable from the limit switch to the cable from the limit switch to the cable from the limit switch to the cable. Fix the limit switch to the J1 base. Remove the cable from the limit switch is covered Cut the cable from the limit switch to the J1 base. Remove the cable from the limit switch to the cable from the limit switch to the J1 base. base, then fix the cable with cable tie. Fix the plate with which the limit switch is covered. 4. J2-axis limit switch to the cable. Fix the limit switch to the cable. Fix the limit switch to the cable. Fix the limit switch to the cable from the limit switch is fixed. plate. Fix the plate to the J2 base. Fix the cable to the J2 base with the plate. 5. J3-axis limit switch replacement 1 Remove the plate. Remove the plate of the J2 arm used to fasten the limit switch from the plate. Remove the plate of the J2 arm used to fasten the limit switch replacement 1 Remove the plate. the terminal in the switch, then remove the limit switch form the cable. Attach a new limit switch to the cable. Install the limit switch cable slackening in the J2 arm. Pull the limit switch cable slackening in the J2 arm. Pull the limit switch cable slackening in the J2 arm. cable is slackening, the cable can rub against the casting and can break as the robot moves. Ensure that the cable does not slacken to rub against the casting is small, sponge covers are wound for protection. When securing the cable, make sure that the sponge covers are placed near the casting shown in the figure. 9 10 Fix the cable fixation plate to the J2 arm. Finally, adjust all limit switches. - 208 - 5.REPLACING CABLES B-82235EN/08 Cable tie Plate J1-axis limit switch (R-2000iB/165F/210F/185L/250F/165R/200R/100P/170CF/125L/175L/100H/150U/220U) Limit switch for J3-axis Casting hole Cover plate Limit switch for J3-axis Fig. 5.4 (b) Replacing J2/J3-axis limit switch (Replacing J2/J3-axis) Limit switch for J3-axis Casting hole Cover plate Limit switch for J3-axis Fig. 5.4 (b) Replacing J2/J3-axis limit switch (Replaced Science 2000iB/165F/210F/185L/250F/165R/200R/100P/125L/175L/100H/150U/220U) - 209 - 5.REPLACING CABLES B-82235EN/08 J1-axis limit switch Plate Bolt M425 Spring washer Plate Limit switch Plate Sponge for protection Terminal in the limit switch Plate Sponge for protection J2-axis limit switch Plate Sponge for protection Terminal in the limit switch Plate Sponge for protection J2-axis limit switch Plate Sponge for protection Terminal in the limit switch Plate Sponge for protection J2-axis limit switch Plate Sponge for protection Terminal in the limit switch Plate Sponge for protection J2-axis limit switch Plate Sponge for protection J2-axis limit switch Plate Sponge for protection J2-axis limit switch Plate Sponge for protection Terminal in the limit switch Plate Sponge for protection J2-axis limit switch Plate Sponge for Plate Sponge f Fig. 5.4 (c) Replacing J1/J2/J3-axis limit switch - 210 - (R-2000iB/165CF) 6.MASTERING B-82235EN/08 6 MASTERING value; corresponding to the zero position. 6.1 OVERVIEW The current position of the robot is determined according to the pulse count value supplied from the Pulsecoder on each axis. Mastering is factory-performed. It is unnecessary to perform mastering in daily operations. Pulsecoder replacement Reducer replacement Cable replacement Batteries for pulse count backup in the mechanical unit have gone dead. WARNING Robot data (including mastering data) and Pulsecoder data are backed up by their respective backup batteries. Data will be lost if the batteries die. Replace the batteries in the controller and mechanical units periodically. An alarm will alert you when battery voltage is low. Mastering methods. Note that "Quick Mastering for Single Axis" is not supported in software version 7DC2(V8.20P) or earlier. Table 6.1 Type of mastering for Single Axis" is not supported in software version 7DC2(V8.20P) or earlier. mark mastering) Quick mastering Quick mastering for single axis Single axis mastering (option) Mastering performed with all axes set at the 0-degree position. A zero-position mark (witness mark) is attached to each robot axis. This mastering is performed with all axes aligned to their respective witness marks. Mastering performed at a user-specified position. The corresponding count value is obtained from the rotation angle within one rotation. Quick mastering uses the fact that the absolute value of a rotation angle within one rotation will not be lost. (All axes at the same time) Mastering performed at a user-specified position for one axis. The corresponding count value is obtained from the rotation angle within one rotation. value of a rotation angle within one rotation will not be lost. Mastering performed for one axis at a time. The mastering position for each axis can be specified by the user. This is useful in performing mastering on a specific axis. specific axis. Enter the Mastering data directly. This MAINTENANCE MANUAL describes fixture position mastering that is mainly required during replacement of parts. For other mastering, the positioning is an operation which recognizes the robot current position loading the pulse count value. - 211 - 6.MASTERING B-82235EN/08 CAUTION 1 If mastering is performed incorrectly, the robot may behave unexpectedly. This is very dangerous. For this reason, the Master/Cal screen is designed to appear only when the \$MASTER ENB system variable is 1 or 2. After performing control of the second screen is designed to appear only when the second screen is designed to appear on the second screen is designed to app positioning, press F5, ([DONE]) on the Master/Cal screen. The \$MASTER_ENB system variable is reset to 0 automatically, and the Master/Cal screen will disappear. 2 Before mastering data be backed up. 6.2 RESETTING ALARMS AND PREPARING FOR MASTERING Before performing mastering because a motor is replaced, you must release the relevant alarm and display the positioning menu. Alarm displayed "Servo 062 BZAL" or "Servo 075 Pulse not established" Procedure 1 Display the positioning menu by following the steps 1 to 6. 1 Press the [MENU] key. 2 Press [0 NEXT] and select [6 SYSTEM]. 3 Press the F1 ([TYPE]), and select [Variable] from the menu. 4 Place the cursor on \$MASTER ENB, then key in "1" and press the [ENTER] key. 5 Press the F1 ([TYPE]), and select [Master/Cal] menu. 2 To reset the "Servo 062 BZAL" alarm, follow steps 1 to 5. 1 Press the [MENU] key. 2 Press [0 NEXT] and select [6 SYSTEM]. 3 Press the F1 ([TYPE]), and select [Master/Cal] from the menu. 4 Place the cursor on the F3 ([RES_PCA]), then press the F4 ([YES]). 5 Cycle power of the controller, the message "Servo 075 Pulse not established" alarm, follow the steps 1 to 2. 1 After cycle power of the controller, the message "Servo 075 Pulse not established" alarm, follow the steps 1 to 2. 1 After cycle power of the controller, the message "Servo 075 Pulse not established" alarm, follow the steps 1 to 2. 1 After cycle power of the controller, the message "Servo 075 Pulse not established" alarm, follow the steps 1 to 2. 1 After cycle power of the controller, the message "Servo 075 Pulse not established" alarm, follow the steps 1 to 2. 1 After cycle power of the controller, the message "Servo 075 Pulse not established" alarm, follow the steps 1 to 2. 1 After cycle power of the controller, the message "Servo 075 Pulse not established" alarm, follow the steps 1 to 2. 1 After cycle power of the controller, the message "Servo 075 Pulse not established" alarm, follow the steps 1 to 2. 1 After cycle power of the controller, the message "Servo 075 Pulse not established" alarm, follow the steps 1 to 2. 1 After cycle power of the controller, the message "Servo 075 Pulse not established" alarm, follow the steps 1 to 2. 1 After cycle power of the controller, the message "Servo 075 Pulse not established" alarm, follow the steps 1 to 2. 1 After cycle power of the controller, the message "Servo 075 Pulse not established" alarm, follow the steps 1 to 2. 1 After cycle power of the controller, the message "Servo 075 Pulse not established" alarm, follow the steps 1 to 2. 1 After cycle power of the controller, the message "Servo 075 Pulse not established" alarm, follow the steps 1 to 2. 1 After cycle power of the controller, the message "Servo 075 Pulse not established" alarm, follow the steps 1 to 2. 1 After cycle power of the controller, the message "Servo 075 Pulse not established" alarm, follow the steps 1 to 2. 1 After cycle power of t established" appears again. 2 Move the axis for which the message mentioned above has appeared in either direction till the alarm disappears when you press [FAULT RESET]. - 212 - 6.MASTERING B-82235EN/08 6.3 FIXTURE POSITION MASTER Fixture position mastering is carried out in the predetermined fixture position. Fixture position mastering is accurate because a dedicated mastering fixture is used. When mastering the robot mounting surface shall be 1 mm or less.) Remove the hand and other parts form the wrist. Set the robot in the condition protected from an external force. Assembling the fixture base as shown in Fig. 6.3 (a) to (d). Pay attention of ダイヤピンの向き diamond locating pin ロボット Front 正面 Bolt ボルト (4pcs) M5x20 (4個) View A 矢視A Plate プ レート A290-7031-X793 A290-7031-X793 16 pin A290-7313-X083 (Pin) O16 ピン A290-7313-X084 A290-7313-X084 A290-7313-X084 locating (ダイヤピン) Bolt ボルト M12x30 M12X30(2pcs) (2個) Base ベース A290-7302-X080 A290-7302-X080 A290-7302-X080 A290-7313-X084 locating (ダイヤピン) Bolt ボルト M5X20 (3pcs) (3 mond (ピン) pin) A290-7313-X084 locating (ダイヤピン) Bolt ボルト M12x30 M12X30(2pcs) (2 個) Base ベース A290-7302-X080 A290-7302-X080 A290-7313-X084 locating (ダイヤピン) Bolt ボルト M12x30 M12X30(2pcs) (2 個) Base ベース A290-7302-X080 A290-7302-X080 A290-7313-X084 locating (ジーン) pin) A290-7313-X084 locating (in) pin) A290-7313-X084 locating (in) pin) A29 個) M5x20 Plate プレート A290-7023-X963 A290-7023-X963 Fig. 6.3 (a) Assembling the fixture base (R-2000iB/165F/210F/250F/170CF/210WE/125L/175L/100H/150U/220U/165CF) - 213 - 6.MASTERING B-82235EN/08 ダイヤピンの向き Direction of diamond locating pin ロボット Front 正面 矢視A A View A Bolt ボルト M5x20 (4 pcs) M5X20 (4 個) プレート Plate A290-7031-X793 A290-7031-X793 16 pin A290-7313-X083 (Pin) 016ピン A290-7313-X083 (Pin) 016ピン A290-7313-X084 (グイヤピン) locating pin) プレート Plate A290-7023-X963 A290-7023-X963 A290-7023-X963 ボルト Bolt M12X30 (2個) M12X30 (2個) M12X30 (2回) アダプタプレート Adapter plate A290-7313-X083 (Pin) 016ピン A290-7313-X084 (グイヤピン) locating pin) プレート Plate A290-7023-X963 A290-7023-X963-X X080 A290-7302-X080 Bolt ボルト M5x20 M5X20(3pcs) (3個) Fig. 6.3 (b) Assembling the fixture base (R-2000iB/185L) Direction of ダイヤピンの向き diamond locating pin ロボット Front 正面 アダプタプレート Adapter plate A290-7324-X082 A290-7324-X082 View A 矢視A ベース Base A290-7302-X080 Bolt ボルト M12X30 (2pcs) (2個) M12x30 16 pin O16 ピン A290-7313-X083 (Pin) A290-7313-X083 (ビン) A290-7313-X084 (Diamond A290-7313-X084 (グイヤピン) locating pin) プレート Plate A290-7031-X793 Bolt ボルト M5x20 (3個) Bolt ボルト M5x20 (4(4個) M5x20 pcs) Plate プレート A290-7023-X963 Fig. 6.3 (c) Assembling the fixture base (R-2000iB/165R/200R) - 214 - 6.MASTERING B-82235EN/08 Direction of ダイヤピンの向き diamond locating pin ロボット Front 正面 Plate プレート A290-7324-X091 View 矢視AA Base ベース A290-7302-X080 Bolt ボルト M12x30 (2個) 16 pin O16 ピン A290-7313-X083 (Pin) (ピン) A290-7313-X083 A290-7313-X084 (Diamond A290-7313-X084 (ダイヤピン) locating pin) Plate プレート A290-7031-X793 A290-7023-X963 Fig. 6.3 (d) Assembling fixture base (R-2000iA/100P) Adjust the dial gauge to 3.00 mm using the calibration block, and tighten it with M5 bolt as shown in Fig.6.3 (e). (Do not tighten the bolt too strongly or the dial gauge C does not exist.) B A 0 3 C F 20mm 2 E M5 bolt M5ボルト Calibration block 較正プロック Fig. 6.3 (e) Mounting dial gauge - 215 - D 6.MASTERING 3 B-82235EN/08 Mount the fixture to the wrist flange as shown Fig. 6.3 (f) to (j). Pay attention the direction of the diamond locating pin. A Bolt ボルト M12×30 (2 pcs) 10 pin A290-7018-X085 (ピン) A290-7018-X085 (CU) A290 fixture base (R-2000iB/165F/210F/250F/170CF/210WE/125L/175L/100H/150U/220U) A Bolt ボルト M12x30 (2 pcs) M12X30 - 216 - 矢視 A 6.MASTERING B-82235EN/08 A 155 Bolt ボルト M12x30 (2(2個) pcs) M12X30 10 pin 155 O10ピン A290-7031-X088(ピン) (pin) A290-7031-X089 locating pin) Front 正面 J1 base J1ベース View 矢視A A MAX 130 Make sure that there is not interference between the mastering fixture and the base マスタリング治具と架台など(J1ベース設置部)の干渉が無いよう 注意してください。 (J1 base installation part). Fig. 6.3 (h) Assembling the fixture base (R-2000iB/165R/200R) A 155 Bolt ボルト M12x30 pcs) M12X30(2 (2個) 10 pin O 10ピン A290-7031-X088 (pin) 155 A290-7031-X088 (ピン) A290-7031-X089 (Diamond A290-7031-X089 (ダイヤピン) locating pin) View A 矢視 A J1ベース J1 base 正面 Front MAX80 (92) Make sure that there is not interference between the mastering fixture and the base マスタリング治具と架台など(J1ベース設置部)の干渉が無いよう 注意してください。 (J1 base installation part). Fig. 6.3 (i) Mounting fixture base (R-2000iB/100P) - 217 - 6.MASTERING B-82235EN/08 Bol M1230 (2pcs) 10 pin (2pcs) 10 pin (2pcs) J1 base Front Fig. 6.3 (j) Assembling the fixture base (R-2000iB/165CF) 4 Assemble the fixture to the wrist flange as shown in Fig. 6.3 (k) to (m). E D Bolt ボルト M10×35 (4pcs) Adapter アダプタ A290-7321-X081 F 10 pin φ 10 ± A290-7018-X085 (pin) A290-7018-X085 (Lン) A290-7018-X085 (Lン) A290-7018-X085 (Lン) A290-7018-X085 (L) A290-7321-X081 F 10 pin φ 10 ± A290-7018-X085 (pin) A290-7018-X085 (L) A290-7018-X085 X092 (Diamond A290-7018-X092 (ダイヤピン) locating pin) C B Direction of diamond locating pin ダイヤピンの向き Wrist center 手首中心 A Fig. 6.3 (k) Assembling the fixture to the wrist, be sure to remove the FANUCF/210WE/125L/175L/150U/100H/220U) CAUTION Before attaching the fixture to the wrist, be sure to remove the FANUCCF/210WE/125L/175L/150U/100H/220U) CAUTION Before attaching the fixture to the wrist flange (R-2000iB/165F/210F/185L/250F/170CF/210WE/125L/175L/150U/100H/220U) CAUTION Before attaching the fixture to the wrist flange (R-2000iB/165F/210F/185L/250F/170CF/210WE/125L/175L/150U/100H/220U) CAUTION Before attaching the fixture to the wrist flange (R-2000iB/165F/210F/185L/250F/170CF/210WE/125L/175L/150U/100H/220U) CAUTION Before attaching the fixture to the wrist flange (R-2000iB/165F/210F/185L/250F/170CF/210WE/125L/175L/150U/100H/220U) CAUTION Before attaching the fixture to the wrist flange (R-2000iB/165F/210F/185L/250F/170CF/210WE/125L/175L/150U/100H/220U) CAUTION Before attaching the fixture to the wrist flange (R-2000iB/165F/210F/185L/250F/170CF/210WE/125L/175L/170CF/210WE/125L/175L/170CF/210WE/125L/175L/170CF/210WE/125L/175L/170CF/210WE/125L/175L/170CF/210WE/125L/170CF/210WE/125L/175L/170CF/210WE/125L/170CF/210WE/125L/170CF/210WE/125L/175L/170CF/210WE/125L/170UE/125L/170UE/170UE/125L/170UE/125L/170UE/125L/170W flange adaptor and special flange adaptor. If adaptor is attached, mastering cannot be performed under the correct posture. - 218 - 6.MASTERING B-82235EN/08 Bolt ボルト M10X35(4本) M1035 (4pcs) C 10 pinピン 010 A290-7018-X085 (ピン) A290-7018-X085 (C'U) A2 タ A290-7321-X081 A290-7321-X081 D E B Direction of diamond locating pin ダイヤピンの向き 手首中心 Wrist center A Fig. 6.3 (l) Assembling the fixture to the wrist flange (R-2000iB/165R/200R/100P) ボルト Bolt (4pcs) (FANUC flange, M10X35M10x35 (4本)(FANUC Jランジ) または Special flange) or M10X40M10x40 (4本) (ISOフランジ) (4pcs) (ISO flange) D Adapter アダプタ A290-7321-X081 (FANUCフランジ) flange) または or A290-7321-X081 (ISOフランジ) A290-7302-X082 (特殊フランジ) A290-7302-X081 (ISOフランジ) A290-7321-X081 (ISO Tange) または or A290-7321-X081 (ISOフランジ) A290-7321-X081 (ISO Tange) または or A290-7321-X081 (ISO Tange) または or A290-7321-X081 (ISO Tange) (ピン) (pin) A290-7018-X085 A290-7031-X092 (ダイヤピン) (Diamond locating pin) or A290-7018-X092 または 9 pin(Special flange) φ 9 ピン (特殊フランジ) A290-7018-X099 (2) (Diamond locating pin) or A290-7018-X099 (2) (Diamond locating pin) or A290-7018-X099 (2) (Diamond locating pin) A290-7031-Y093 (ピン) (Diamond locating pin) or A290-7018-X099 (2) (Diamond locating pin) A290-7018-X099 (2) (Diamond locating pin) or A290-7018-X099 (2) (Diamond locating pin) A290-701 6.3 (m) Assembling the fixture to the wrist flange (R-2000iB/165CF) - 219 - 6.MASTERING B-82235EN/08 Mastering 1 2 3 4 Press the [MENU] key to show screen switch menu. Press [0 NEXT] and select [6 SYSTEM]. Press F1 [TYPE] to show screen menu. Press F1 [TYPE] to show screen switch menu. Select Master/Cal SYSTEM Mastering 1 2 3 4 Press the [MENU] key to show screen switch menu. Press [0 NEXT] and select [6 SYSTEM]. Press F1 [TYPE] to show screen switch menu. Select Master/Cal SYSTEM Mastering 1 2 3 4 Press the [MENU] key to show screen switch menu. Press F1 [TYPE] to show screen switch menu. Press [0 NEXT] and select [6 SYSTEM]. Press F1 [TYPE] to show screen switch menu. Select Master/Cal SYSTEM Mastering 1 2 3 4 Press the [MENU] key to show screen switch menu. Press [0 NEXT] and select [6 SYSTEM]. Press F1 [TYPE] to show screen switch menu. Press [0 NEXT] and select [6 SYSTEM]. Press F1 [TYPE] to show screen switch menu. Press [0 NEXT] and select [6 SYSTEM]. Press F1 [TYPE] to show screen switch menu. Press [0 NEXT] and select [6 SYSTEM]. Press F1 [TYPE] to show screen switch menu. Press [0 NEXT] and select [6 SYSTEM]. Press F1 [TYPE] to show screen switch menu. Press [0 NEXT] and select [6 SYSTEM]. Press F1 [TYPE] to show screen switch menu. Press [0 NEXT] and select [6 SYSTEM]. Press F1 [TYPE] to show screen switch menu. Press [0 NEXT] and select [6 SYSTEM]. Press F1 [TYPE] to show screen switch menu. Press [0 NEXT] and select [6 SYSTEM]. Press F1 [TYPE] to show screen switch menu. Press [0 NEXT] and select [6 SYSTEM]. Press F1 [TYPE] to show screen switch menu. Press [0 NEXT] and select [6 SYSTEM]. Press F1 [TYPE] to show screen switch menu. Press [0 NEXT] and select [6 SYSTEM]. Press F1 [TYPE] to show screen switch menu. Press [0 NEXT] and select [6 SYSTEM]. Press F1 [TYPE] to show screen switch menu. Press [0 NEXT] and select [6 SYSTEM]. Press [6 NEXT] and TORQUE = [ON] 1 FIXTURE POSITION MASTER 2 ZERO POSITION MASTER 3 QUICK MASTER FOR SINGLE AXIS 5 SIN to F (see Fig.6.3 (e)) of the fixture attached to the wrist are dial gauges A to F (see Figs. 6.3 (k) to (m)) and make adjustments so that dial gauges A to F indicate 3 mm. A posture as shown in Fig.6.3 (n) to (x) should be taken. \$PARAM_GROUP.\$SV_OFF_ALL: FALSE \$PARAM_GROUP.\$SV_OFF_ENB[*]: FALSE (for all axes) After changing the system variables, turn off the controller power and on again. 6 Select "1 FIXTURE POSITION MASTER" and Press F4, YES. "MASTER POSITION" shown in Figs.6.3 (n) to (x) is set in this position. SYSTEM Master/Cal AUTO JOINT 10 % TORQUE = [ON] 1 FIXTURE POSITION MASTER 2 ZERO POSITION MASTER 3 QUICK MASTER FOR SINGLE AXIS 5 SINGLE AXIS 7 CALIBRATE Robot Mastered! Mastering Data: [TYPE] LOAD RES_PCA DONE - 220 - 6.MASTERING B-82235EN/08 7 Select "7 CALIBRATE" and press F4 [YES]. Position arrangement will be performed. Alternatively, cycle power of the controller to perform position arrangement. SYSTEM Master 2 ZERO POSITION MASTER 3 QUICK MASTER 4 QUICK MASTER FOR SINGLE AXIS 5 SINGLE AXIS MASTER 6 SET QUICK MASTER REF 7 CALIBRATE Robot Calibrated! Cur Jnt Ang(deg): [TYPE] 8 LOAD RES PCA DONE After completing the calibration, press F5 Done. DONE F5 9 Return brake controller. CAUTION No check is made on the axis movable range during mastering. Be very careful when running the robot. Continuing axis movement may bump into the mechanical stopper. - 221 - 6.MASTERING B-82235EN/08 J2 MASTERING POSITION (INSULATED FLANGE) AXIS POSITION J1 0 deg J2 +24.4530 deg J3 -94.9590 deg J4 0 deg J2 +24.6840 deg J3 -94.1150 deg 0 deg J4 -85.8850 deg J5 J6 0 deg J5 Fig. 6.3 (n) Mastering position (R-2000iB/165F/150U) J2 MASTERING POSITION (STANDARD FLANGE) AXIS POSITION (STANDARD FLANGE) AXIS POSITION 0 deg J1 J2 +24.6528 deg J3 -94.2241 deg 0 deg J4 -85.7759 deg J5 J6 0 deg J5 J6 0 deg J5 J6 0 deg J5 Fig. 6.3 (n) Mastering position (R-2000iB/165F/150U) J2 MASTERING POSITION (STANDARD FLANGE) AXIS POSITION 0 deg J1 J2 +24.6528 deg J3 -94.2241 deg 0 deg J4 -85.7759 deg J5 J6 0 deg J5 J6 0 deg J5 Fig. 6.3 (n) Mastering position (R-2000iB/165F/150U) J2 MASTERING POSITION (STANDARD FLANGE) AXIS POSITION 0 deg J1 J2 +24.6528 deg J3 -94.2241 deg 0 deg J4 -85.7759 deg J5 J6 0 deg J5 J6 0 deg J5 Fig. 6.3 (n) Mastering position (R-2000iB/165F/150U) J2 MASTERING POSITION (STANDARD FLANGE) AXIS POSITION (STAND -93.3974 deg J4 0 deg -86.6026 deg J5 J6 0 deg J5 Fig. 6.3 (o) Mastering position (R-2000iB/210F/250F/210WE/220U) - 222 - 6.MASTERING POSITION (STANDARD FLANGE) AXIS POSITION J1 0 deg J2 -18.6117 deg J3 -59.1150 deg J4 0 deg J5 -120.885 deg J6 0 deg MASTERING POSITION (INSULATED FLANGE) AXIS POSITION J1 0 deg J2 -18.6117 deg J3 -59.1150 deg J4 0 deg J5 -120.885 deg J6 0 deg MASTERING POSITION (INSULATED FLANGE) AXIS POSITION J1 0 deg J2 -18.6117 deg J3 -59.1150 deg J4 0 deg J5 -120.885 deg J6 0 deg MASTERING POSITION (INSULATED FLANGE) AXIS POSITION J1 0 deg J2 -18.6117 deg J3 -59.1150 deg J4 0 deg J5 -120.885 deg J6 0 deg MASTERING POSITION (INSULATED FLANGE) AXIS POSITION J1 0 deg J2 -18.6117 deg J3 -59.1150 deg J4 0 deg J5 -120.885 deg J6 0 deg MASTERING POSITION (INSULATED FLANGE) AXIS POSITION J1 0 deg J2 -18.6117 deg J3 -59.1150 deg J4 0 deg J5 -120.885 deg J6 0 deg MASTERING POSITION (INSULATED FLANGE) AXIS POSITION J1 0 deg J2 -18.6117 deg J3 -59.1150 deg J4 0 deg J5 -120.885 deg J6 0 deg MASTERING POSITION (INSULATED FLANGE) AXIS POSITION J1 0 deg J2 -18.6117 deg J3 -59.1150 deg J4 0 deg J5 -120.885 deg J6 0 deg MASTERING POSITION (INSULATED FLANGE) AXIS POSITION J1 0 deg J2 -18.6117 deg J3 -59.1150 deg J4 0 deg J5 -120.885 deg J6 0 deg MASTERING POSITION (INSULATED FLANGE) AXIS POSITION J1 0 deg J2 -18.6117 deg J3 -59.1150 deg J4 0 deg J5 -120.885 deg J6 0 deg MASTERING POSITION (INSULATED FLANGE) AXIS POSITION J1 0 deg J2 -18.6117 deg J3 -59.1150 deg J4 0 deg J5 -120.885 deg J6 0 deg MASTERING POSITION (INSULATED FLANGE) AXIS POSITION J1 0 deg J2 -18.6117 deg J3 -59.1150 deg J4 0 deg J5 -120.885 deg J6 0 deg MASTERING POSITION (INSULATED FLANGE) AXIS POSITION J1 0 deg J2 -18.6117 deg J3 -59.1150 deg J4 0 deg J5 -120.885 deg J6 0 deg MASTERING POSITION (INSULATED FLANGE) AXIS POSITION J1 0 deg J3 -59.1150 deg J4 0 deg J5 -120.885 deg J6 0 deg MASTERING POSITION (INSULATED FLANGE) AXIS POSITION J1 -120.885 deg J6 0 deg MASTERING POSITION (INSULATED FLANGE) AXIS POSITION (INSULATED FLANGE) AXIS POSITION AXIS POSITION 0 deg J1 J2 -16.4601 deg J3 -59.7769 deg 0 deg J4 J5 -120.2231 deg J6 0 deg J5 Fig. 6.3 (p) Mastering position (R-2000iB/185L) MASTERING POSITION J1 0 deg J2 -19.2475 deg J3 -51.9259 deg J4 0 deg J4 0 deg J5 Fig. 6.3 (p) Mastering position (R-2000iB/185L) MASTERING POSITION J1 0 deg J2 -19.2475 deg J3 -51.9259 deg J4 0 deg J4 0 deg J4 J5 -120.2231 deg J6 0 deg J4 0 deg J5 Fig. 6.3 (p) Mastering position (R-2000iB/185L) MASTERING POSITION J1 0 deg J2 -19.2475 deg J3 -51.9259 deg J4 0 deg J4 0 deg J4 J5 -120.2231 deg J6 0 deg J4 J5 -120.2231 deg J6 0 deg J4 0 deg J4 J5 -120.2231 deg J6 0 deg J4 J5 -120.2231 deg J6 0 deg J4 J5 -120.2231 deg J5 Fig. 6.3 (p) Mastering position (R-2000iB/185L) MASTERING POSITION J1 0 deg J2 -19.2475 deg J3 -51.9259 deg J4 0 deg J4 J5 -120.2231 deg J6 0 deg J4 J5 -120.2231 deg J5 Fig. 6.3 (p) Mastering position (R-2000iB/185L) MASTERING POSITION J1 0 deg J2 -19.2475 deg J3 -51.9259 deg J4 0 deg J4 J5 -120.2231 deg J6 0 deg J5 Fig. 6.3 (p) Mastering position (R-2000iB/185L) MASTERING POSITION J1 0 deg J5 -120.2231 deg J6 0 deg J4 J5 -120.2231 deg J6 0 deg J4 J5 -120.2231 deg J6 0 deg J4 J5 -120.2231 deg J6 0 deg J5 0 deg J2 -24.9082 deg J3 -49.9583 deg J4 0 deg -40.0417 deg J5 J6 0 deg J2 J3 J5 Fig. 6.3 (q) Mastering position (R-2000iB/165R) - 223 - 6.MASTERING POSITION J1 0 deg J2 -20.6962 deg J3 -50.2127 deg J4 0 deg -39.7873 deg J5 J6 0 deg B-82235EN/08 MASTERING POSITION (INSULATED FLANGE) AXIS POSITION J1 0 deg J2 -22.2854 deg J3 -48.2806 deg J4 0 deg -41.7194 deg J5 J6 0 deg J2 J3 J5 Fig. 6.3 (r) Mastering position (R-2000iB/200R) MASTERING POSITION (INSULATED FLANGE) POSITI POSITION AXIS 0 deg J1 -55.3184 deg J2 -18.4928 deg J3 -65.679 deg J4 0 deg J5 -114.321 deg 0 J4 -71.5072 deg J5 J6 deg 0 J2 J3 J5 Fig. 6.3 (s) Mastering position (R-2000iB/100P) - 224 - 6.MASTERING B-82235EN/08 MASTERING B-82235 POSITION (INSULATED FLANGE) AXIS POSITION 0 deg J1 J2 +33.577 deg J3 -64.416 deg J4 0 deg J5 -115.584 deg 0 deg J6 J5 Fig. 6.3 (t) Mastering position (R-2000iB/170CF) J2 J3 MASTERING POSITION (STANDARD FLANGE) AXIS POSITION 0 J1 deg J2 -16.036 deg J3 -62.673 deg J4 0 deg J5 J6 0 deg J5 J6 0 deg MASTERING POSITION (STANDARD FLANGE) AXIS POSITION 0 J1 deg J2 -16.036 deg J3 -62.673 deg J4 0 deg J5 J6 0 deg MASTERING POSITION (STANDARD FLANGE) AXIS POSITION 0 J1 deg J2 -16.036 deg J3 -62.673 deg J4 0 deg J5 J6 0 deg J5 J6 0 deg MASTERING POSITION (STANDARD FLANGE) AXIS POSITION 0 J1 deg J2 -16.036 deg J3 -62.673 deg J4 0 deg J5 J6 0 deg MASTERING POSITION (STANDARD FLANGE) AXIS POSITION (STANDARD FLANGE) AXIS POSITION 0 J1 deg J2 -16.036 deg J3 -62.673 deg J4 0 deg J5 J6 0 deg MASTERING POSITION (STANDARD FLANGE) AXIS POSITION 0 J1 deg J2 -16.036 deg J3 -62.673 deg J4 0 deg J5 J6 0 deg MASTERING POSITION (STANDARD FLANGE) AXIS POSITION 0 J1 deg J2 -16.036 deg J3 -62.673 deg J4 0 deg J5 J6 0 deg MASTERING POSITION (STANDARD FLANGE) AXIS POSITION 0 J1 deg J2 -16.036 deg J3 -62.673 deg J4 0 deg J5 J6 0 deg MASTERING POSITION (STANDARD FLANGE) AXIS POSITION 0 J1 deg J2 -16.036 deg J3 -62.673 deg J4 0 deg J5 J6 0 deg MASTERING POSITION (STANDARD FLANGE) AXIS POSITION 0 J1 deg J2 -16.036 deg J3 -62.673 deg J4 0 deg J5 J6 0 deg MASTERING POSITION (STANDARD FLANGE) AXIS POSITION 0 J1 deg J2 -16.036 deg J3 -62.673 deg J4 0 deg J5 J6 0 deg MASTERING POSITION (STANDARD FLANGE) AXIS POSITION 0 J1 deg J2 -16.036 deg J3 -62.673 deg J4 0 deg J5 J6 0 deg MASTERING POSITION (STANDARD FLANGE) AXIS POSITION 0 J1 deg J2 -16.036 deg J3 -62.673 deg J4 0 deg J5 J6 0 deg MASTERING POSITION (STANDARD FLANGE) AXIS POSITION (ST (INSULATED FLANGE) POSITION AXIS 0 J1 deg J2 -13.972 deg -63.282 deg J3 J4 0 deg J5 -116.718 deg J6 0 deg J5 -116.718 deg J6 0 deg J5 -103.0681 deg J6 0 deg J5 -103.0681 deg J6 0 deg J5 -103.0681 deg J6 0 deg J6 0 deg J6 0 deg J6 0 deg J6 -116.718 deg J6 0 deg J5 -103.0681 deg J6 0 MASTERING POSITION (INSULATED FLANGE) AXIS POSITION J1 0 deg J2 +2.4534 deg J3 -76.8594 deg J3 position (R-2000iB/100H) - 226 - 6.MASTERING B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.3 (x) Mastering position (R-2000iB/165CF) - 227 - 6.MASTERING 6.4 1 2 B-82235EN/08 Fig. 6.4 1 2 B-822 performed correctly, examine if the current displayed position meets the actual robot position by using the procedure described below: (1) Reproduce a particular point in a program. Check that the zero-degree position marks indicated in Section 8.3 of OPERATOR'S MANUAL are aligned. There is no need to use a visual aid. (3) Using fixtures, set the robot to the mastering position in the same way as when performing mastering. Check that the displayed current position agrees with the actual mastering position. If the displayed and actual positions do not match, the counter value for a Pulsecoder may have been invalidated as a result of an alarm described in 6.2. Alternatively, the mastering data in system variable \$DMR_GRP.\$MASTER_COUN may have been overwritten as a result of an operation error or some other reason. variable is overwritten whenever mastering is performed. Whenever mastering is performed, record the value of the system variable on the data sheet. Alarm This alarm is displayed during mastering and their solution method: (1) BZAL alarm This alarm is displayed if the Pulsecoder's backup battery voltage decreases to 0 V while the power to the controller is disconnected. Furthermore, if the Pulsecoder connector is removed for cable replacement, etc. this alarm is displayed as the voltage decreases to 0. Confirm if the alarm will disappears or not. The battery may be drained if the alarm is still displayed. Perform a pulse reset, and turn off and on the controller power after replacing the battery. Note that, if this alarm is displayed, all the voltage of the Pulsecoder's backup battery has fallen to a level where backup is no longer possible. If this alarm is displayed, replace the battery with a new one immediately while keeping the power turned on. Check whether the current position data is valid, using the procedure described in 1. (3) Alarm notification like CKAL, RCAL, PHAL, CSAL, DTERR, CRCERR, STBERR, and SPHAL may have trouble with Pulsecoder, contact your local FANUC representative. - 228 - 7.SEVERE DUST/LIQUID PROTECTION PACKAGE 60710N) The package is intended to improve the Severe dust/Liquid protection characteristics of the robot so that it can be used in a severe environment. Model R-2000iB/165F/125L R-2000iB/165R Protection Characteristics The following table lists the IEC60529-based Severe dust/Liquid protection characteristics of the R-2000iB. Standard Severe dust/Liquid protection package IP67 IP66 IP56 J3 arm and wrist section Drive unit of the main body (*) Except some connectors Main body : IP56 本体部: IP56 J3J3軸アーム - 229 - 7.SEVERE DUST/LIQUID PROTECTION PACKAGE 7.1.2 B-82235EN/08 Configuration of the Severe Dust/Liquid Protection Package The following table lists the major differences between the R-2000iB standard severe dust/liquid protection package. Bolts Standard specifications Entire mechanical unit J3 arm and wrist Black oxide finish steel bolt Black oxide finish steel bolt Stainless bolt FR coating bolt FR coa axis motor cover J2-axis motor cover J3-axis motor covers (upper and lower) Battery box cover Cable protection sheath in mechanical unit (for all exposed cables) Waterproof connector SJ3/J4/J5/J6-axis J3/J4/J5/J6-axis J3/J4/J5/J6-axis J3/J4/J5/J6-axis J3/J4/J5/J6-axis motor covers (upper and lower) Battery box cover Cable protection sheath in mechanical unit (for all exposed cables) Waterproof connector SI3 connector SI3/J4/J5/J6-axis J3/J4/J5/J6-axis J3/J4/J 軸 motor cover モータカバー (上) (upper side) J3/J4/J5/J6-axis motor cover J3/J4/J5/J6軸 (lower side) モータカバー (下) J1軸モータカバー J1-axis motor cover J2-axis motor cover J2-axis motor cover J2-axis motor cover J2/J4/J5/J6 axis motor cover J2/J4/J5/J6 axis motor cover J2-axis moto 7.SEVERE DUST/LIQUID PROTECTION PACKAGE B-82235EN/08 7.1.3 1 Notes on Specifying Severe Dust/Liquid Protection Package The liquids below cannot be applied because they may cause deterioration or corrosion of the rubber parts (such as gaskets, oil seals, and O-rings) used in the robot. (a) Organic solvent (b) Chlorine- or gasoline-based cutting fluid (c) Amine-based cleaning fluid (d) Liquid or solution to which nitrile rubber (NBR) does not have resistance When the robot is used in an environment where a liquid such as water is dashed over the robot, great attention should be given to drainage under the J1-axis base. A failure may be caused if the J1-axis base is kept immersed in water due to poor drainage. 2 7.2 REPLACING SEVERE DUST/LIQUID PROTECTION PACKAGE COMPONENTS 7.2.1 Replacing Motor Covers as required according to Section 4.10. Ensure that all bolts are stainless. 7.2.2 Replacing Cable Protection Sheaths Cable protection sheath are attached to all otherwise exposed cables in the undesirable-environment option. After a cable or cable protection sheath is replaced, mount the cover as shown in Fig. 7.2.2 (a) to (c). NOTE 1 Fasten a cable protection sheath end to a connector or cable with a cable tie while gathering wrinkles in the cable protection sheath end neatly. 2 Mount each cable protection sheath in such a manner that the Velcro on it is downward or that its covering side (male side) laps over the other side from above, so as to keep water from getting or lingering in the cover. Cable ケーブル Cable ケーブル Cable ケーブルカバー マジックテープ Velcro Example of good covering 良い例 231 - Example 悪い例 of bad covering 7.SEVERE DUST/LIQUID PROTECTION PACKAGE Put end of cable protection sheath A290-7329-X621 inside cable protection sheath A290-7329-X621 Put end of cable protection sheath A290-7329-X619 inside cable protection sheath A290-7324-X620 (or A290-7324-X622). Cable protection sheath A290-7324-X620 (except 150U) A290-7324-X619 Cable protection sheath A290-7324-X615 Cable protection sheath A290-7324-X614 Cable protection sheath A290-7324-X620 (except 150U) A290-7324-X619 Cable protection sheath A290-7324-X615 Cable protection sheath A290-7324-X615 Cable protection sheath A290-7324-X614 Cable protection sheath A290-7324-X619 Cable protection sheath A290-7324-X615 Cable protection sheath A290-7324-X614 Cable protection sheath A290-7324-X619 Cable protection sheath A290-7324-X614 Cable protection sheath A290-7324-X619 Cable protection sheath A290-7324-X614 Cable protection sheath A290-7324-X614 Cable protection sheath A290-7324-X619 Cable protection sheath A290-7324-X614 Cable prot 7329-X618 Cable protection sheath A290-7329-X617 Cable protection sheath A290-7329-X617. Put end of cable protection sheath A290-7329-X617. Put end of cable protection sheath A290-7329-X617 Cable protection sheath A290-7329-X617. Put end of cable protection sheath A290-7329-X617 Cable protection sheath A290-7329-X617. Put end of cable protection sheath A290-7329-X617. Put end of cable protection sheath A290-7329-X617 Cable protection sheath A290-7329-X617. Put end of cable protection sheath A290-7329-X617 Cable protection sheath A290-7329-X617. Put end of cable protection sheath A290-7329-X617 Ca Fig. 7.2.2 (a) Mounting the cable protection sheath A290-7324-Y621 Cable protection sheath A290-7324-Y621 Cable protection sheath A290-7324-Y621 Cable protection sheath A290-7324-Y621 inside cable protection sheath A290-7324-Y621 Cable protection sheath A290-7329-X618 Cable protection sheath A290-7324-Y621 inside cable protection sheath A290-7329-Y619 Put end of cable protection sheath A290-7329-Y614 inside cable protection sheath A290-7324-Y620. Cable protecti 7324-X615 Cable protection sheath A290-7329-X614 Cable protection sheath A290-7329-X617 Cable protection sheath A290-7329-X617. Mounting the cable protection sheath A290-7329-X618 inside cable protection sheath A290-7329-X617. sheath (R-2000iB/165R/200R) - 232 - 7.SEVERE DUST/LIQUID PROTECTION PACKAGE B-82235EN/08 Cable protection sheath A290-7329-Z618 Put end of cable p Cable protection sheath A290-7329-Z614 Cable protection sheath A290-7329-Z616 Cable protection sheath A290-7329-Z616 Cable protection sheath A290-7329-Z617 Cable protection sheath A290-7329-Z617 Cable protection sheath A290-7329-Z616 Cable protection sheath A290-7329-Z617 Cable protection sheath A290-7329-Z617 Cable protection sheath A290-7329-Z617 Cable protection sheath A290-7329-Z616 Cable protection sheath A290-7329-Z617 Cable protection s A290-7329-Z616, Then put end of cable protection sheath A290-7329-Z615 inside cable protection sheath A290-7329-Z616, Then put end of cable protection sheath A290-7329-Z617. Fig. 7.2.2 (c) Mounting the cable protection sheath (R-2000iB/170CF) - 233 - APPENDIX APPENDIX B-82235EN/08 A A.MAINTENANCE PARTS MAINTENANCE PARTS CAUTION If you order cable only, housing of Harting connector is not included. (Except R-2000iB/165CF) Table A (a) No. Specifications K111 K112 K211 K212 K311 K312 K115 A660-8015-T300 A660-8015-T301 A660-8015-T843 A660-8015-T844 A660-8016-T658 F659 A660-8016-T231 A660-8016-T233 A660-8015-T904 A660-8015-T904 A660-8016-T661 A660-8015-T846 A660-8015-T847 A660-8015-T847 A660-8015-T848 K615 A660-8015-T941 K711 K712 A660-8016-T661 A660-8016-T662 K715 A660-8015-T846 A660-8015-T847 A660-8015-T848 K615 A660-8015-T847 A660-8015-T847 A660-8015-T847 A660-8015-T847 A660-8015-T847 A660-8015-T847 A660-8015-T847 A660-8015-T847 A660-8015-T847 A660-8015-T941 K711 K712 A660-8016-T661 A660-8016-T662 K715 A660-8015-T847 T899 K516 K517 K519 K520 K527 K528 K523 K515 A660-8016-T232 A660-8016-T234 A660-8017-T642 A660-8017-T642 A660-8017-T643 A660-8017-T909 A660-8 to J6 PULSECODER+EE J1 to J6 PULSECODER J1 ~ J6 PULSECODER+EE J1 to (Severe dust liquid option) J1 ~ J6 PULSECODER+EE J1 to J6 PULSECODE /125L/175L/150U R-2000iB/165R/200R/100P R-2000iB/100P R-2000 Specifications K131 K132 K133 K135 K136 K137 K138 K139 K140 K231 K232 K233 K235 K236 K137 K238 K239 K240 K331 K332 K335 K336 K137 K238 K339 K340 K143 K144 K273 K274 K291 K286 A660-2006-T290 A660-8015-T612 A660-8015-T618 A05B-1329-D003 A660-2006-T207 A660-8015-T352 A660-8015-T612 A660-8015-T618 A05B-1329-D003 A660-2006-T207 A660-8015-T352 A660-8015-T618 A05B-1329-D003 A660-8015-T618 A05B-1329-D003 A660-8015-T618 A05B-1329-D003 A660-8015-T618 A05B-1329-D003 A660-8015-T618 A05B-1329-D003 A660-8015-T618 A05B-1329-D003 A660-8015-T352 A660-8015-T352 A660-8015-T618 A05B-1329-D003 A660-8015-T618 A05B-1329-D003 A660-8015-T618 A05B-1329-D003 A660-8015-T618 A05B-1329-D003 A660-8015-T352 A660-8015-T352 A660-8015-T618 A05B-1329-D003 A660-8015-T352 A660-8015-T352 A660-8015-T618 A05B-1329-D003 A660-8015-T352 A660-8015-T352 A660-8015-T352 A660-8015-T352 A660-8015-T618 A05B-1329-D003 A660-8015-T352 A660-8015-T352 A660-8015-T352 A660-8015-T618 A05B-1329-D003 A660-8015-T618 A05B-1329-D003 A660-8015-T352 A660-8015-T352 A660-8015-T352 A660-8015-T352 A660-8015-T618 A05B-1329-D003 A660-8015-T352 A T620 A660-8015-T622 A660-2006-T383 A660-8015-T853 A660-8015-T853 A660-8015-T853 A660-8015-T853 A660-8015-T857 A660-8015-T857 A660-8016-T553 A660-8016-T553 A660-8016-T553 A660-8015-T857 A660-8016-T555 A660-8016-T555 A660-8016-T555 A660-8015-T857 A660-8016-T555 A600-8016-T555 A A660-8014-T365 A660-4003-T939 A660-4003-T940 A05B-1321-D017 A660-8013-T449 A660-8014-T020 A660-8014-T030 Cables (Option) Function AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J2J3) I/O Unit MODEL B J123 OT short circuit cable J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J2J3) I/O Unit MODEL B J123 OT short circuit cable J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J2J3) I/O Unit MODEL B J123 OT short circuit cable J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J2J3) I/O Unit MODEL B J123 OT short circuit cable J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J2J3) I/O Unit MODEL B J123 OT short circuit cable J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J2J3) I/O Unit MODEL B J123 OT short circuit cable J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J2J3) I/O Unit MODEL B J123 OT short circuit cable J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J2J3) I/O Unit MODEL B J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J2J3) I/O Unit MODEL B J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) AP (USER/POWER) AP (USER/PO (POWER) (J1J2J3) I/O Unit MODEL B J123 OT short circuit cable J123 OT ARP ARM AS AP DS (SIGNAL) DP (POWER) (J1J2J3) I/O Unit MODEL B J123 OT ARP ARM AS AP DS (SIGNAL) DP (POWER) (J1J2J3) I/O Unit MODEL B J123 OT ARP ARM AS AP DS (SIGNAL) DP (POWER) (J1J2J3) I/O Unit MODEL B J123 OT short-circuit cable J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J1J2J3) I/O Unit MODEL B J123 OT ARP ARM AS AP DS (SIGNAL) DP (POWER) (J1J2J3) I/O Unit MODEL B J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J1J2J3) I/O Unit MODEL B J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J1J2J3) I/O Unit MODEL B J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J1J2J3) I/O Unit MODEL B J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J1J2J3) I/O Unit MODEL B J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J1J2J3) I/O Unit MODEL B J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J1J2J3) I/O Unit MODEL B J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J1J2J3) I/O Unit MODEL B J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) DP (POWER) (J1J2J3) I/O Unit MODEL B J123 OT ARP ARM AS (USER/SIGNAL) AP (USER/POWER) DS (SIGNAL) A 2000iB/165F/210F/185L/250F /125L/175L/100H/150U R-2000iB/165R/200R/100P R-2000iB/165CF A.MAINTENANCE PARTS APPENDIX B-82235EN/08 Table A (d) No. K531 K532 K535 K536 K539 K540 K530 K541 K542 K545 K549 K578 K591 K592 K595 Specifications A660-2006-T291 A660-8015-T613 A660-8015-T615 A660 8015-T619 A05B-1329-D004 A660-8015-T621 A660-8015-T623 A05B-1329-D026 A05B-1329-D ARM FAN CABLE (J1/J2/J3) (*) I/O Unit MODEL B FAN CABLE (J1/J2) (*) FAN CABLE (J1/J2) (* K732 K733 K735 K736 K739 K740 K536 K542 K543 K281 K545 K544 A660-2006-T384 A660-2006-T384 A660-2006-T384 A660-8015-T850 A660-8015-D056 A660-8016-T557 A660-8016-T557 A660-8016-T557 A660-8016-T557 A660-8016-T558 A660-8016-T558 A660-8016-T558 A660-8014-T366 A660-8014-T366 A660-8014-T367 A660-8014-T367 A660-8014-T367 A660-8016-T558 A660-8016-T558 A660-8016-T558 A660-8014-T366 A660-8014-T367 A660-8014-T367 A660-8014-T367 A660-8016-T558 A660-8014-T367 A MODEL B ARP ARM FAN CABLE (J1/J2/J3) (*) FAN C 2000iB/165F/210F/185L/250F /125L/175L/100H/150U/220U R-2000iB/165F/210F/185L/250F /125L/175L/150U R-2000iB/165F/210F/185L/250F /125L/150U R-2000iB/165F/210F/185L/250F /125L/15 February 27,2011 or before : K542, K545, K642, K645 February 28,2011 or later : K530, K549, K648, K649 Check the tag of cable and be careful not to mistake when replacing parts. - 239 - A.MAINTENANCE PARTS APPENDIX J1, J2, J3 Table A (e) Motor Specifications Remarks iSR30/3000 A06B-0041-B605#S042 J4, J5, J6 A06B-0238-B605#S000C + S042, K649 Check the tag of cable and be careful not to mistake when replacing parts. - 239 - A.MAINTENANCE PARTS APPENDIX J1, J2, J3 Table A (e) Motor Specifications Remarks iSR30/3000 A06B-0041-B605#S042 J4, J5, J6 A06B-0238-B605#S000C + S042, K649 Check the tag of cable and be careful not to mistake when replacing parts. - 239 - A.MAINTENANCE PARTS APPENDIX J1, J2, J3 Table A (e) Motor Specifications Remarks iSR30/3000 A06B-0041-B605#S042 J4, J5, J6 A06B-0238-B605#S000C + S042 F4, J5, J6 A06B-0248-B605#S000C + S042 F4, J6 A06B-0248-B605#S000C + S042 F4, J5, J6 A06B-0248-B605#S000C + S042 F4, J5, J6 A06B-0248-B605#S000C + S042 F4, J5, J6 A06B-0248-B iS12/4000 J2 J2, J3 J1, J4, J5, J6 J1, J2, J3 A06B-0238-B605#S100 A06B-0235-B605#S100 A06B-0238-B605#S100 iS8/4000 B-82235EN/08 Models R-2000iB/165F/210F/185L/250F/165R /200R/100P/125L/175L/100H/150U /220U (except J2) R-2000iB/210WE (A05B-1329-B255) R-2000iB/210WE (A05B-1329-B25) R-2000iB/210WE (A05B-1329-B25) R-2000iB/210WE (A05B-1329-B25) R-2000iB/210WE (A05B-1329-B25) R-2000iB/210WE (A05B-1329-B25) R-2000iB/210WE (A05B-1329-B25) R-2000iB/210WE (A05B axis reducer J4-axis reducer Table A (f) Reducer Specifications Models R-2000iB/165F/210F/185L/250F/165R/200R A97L-0218-0382#320CA229 R-2000iB/170CF/150U/220U A97L-0218-0382#320CA229 R-2000iB/170CF/150U/220U A97L-0218-0382#320CA229 R-2000iB/165CF A97L-0218-0382#320CA229 R-2000iB/170CF/150U/220U A97L-0218-0382#320CA229 R-2000iB/170CF/150U/ 0237#320C-35 R-2000iB/165F/170CF/125L A97L-0218-0383#450N-236 R-2000iB/165R A97L-0218-0383#450N-236 R-2000iB/210F/100P/175L A97L-0218-0383#450N-236 R-2000iB/200R/150U A97L-0218-000IB/200R/150U A97L-0218-000IB/200R/150U A97L-0218-000IB/200R/150U A97L-0218-000IB/200R/150U A97L-0218-000IB/200R/150U A97L-0218-000IB/200R/150U A97L-0218-000IB/200R/150U A97L-0218-000IB/200R/150U A97L-0200IB/200R/150U A97L-0200IB/200R 0383#450N-187 R-2000iB/220U A97L-0218-0383#450N-235 R-2000iB/165CF A97L-0218-0383#450N-270 R-2000iB/165CF A97L-0218-0383#450N-235 R-2000iB/165CF A97L-0218-035 R-2000iB/165CF A97L-0218-035 R-2000iB/165CF A97L-0218-035 R-2000iB/165CF A97L-0218-035 R-2000iB/165CF A97L-0218-035 R-2000iB/165CF A97L-0218-035 R-2000iB/165CF A97L-0218-0 A97L-0218-0929#450N-270 R-2000iB/100H A97L-0218-0384#320N-183 R-2000iB/165CF A97L-0218-0385#70N-35 R-2000iB/165CF A97L-0218-0239#320E-190 R-2000iB/165CF A97L-0218-0385#70N-35 R-2000iB/165CF A97L-0218-0385#70N-35 R-2000iB/165CF A97L-0218-0385#70N-35 R-2000iB/165CF A97L-0218-0345#70N-35 R-2000iB NOTE When the J5 or J6-axis reducer is broken (J4 or J5-axis in case of R-2000iB/100H), replace the wrist unit. - 240 - APPENDIX B-82235EN/08 Name J1-axis spur gear J1-axis s X222 A97L-0001-0192#3000000 A97L-0218-0802#236 A97L-0218-0802#252 A97L-0218-0802#252 A97L-0218-0802#252 A97L-0218-0802#270 A97L-0218-0802 gear A290-7324-X421 A290-7324-X423 A290-7324-X423 A290-7324-X423 A290-7324-X423 A290-7324-X423 A290-7324-X423 A290-7324-X423 A290-7324-X423 A290-7324-X423 A290-7324-X425 A290-7324-X423 A290-7324-X425 A290-7324-X423 A290-7324-X425 A290-7324-X423 A290-7324-X423 A290-7324-X423 A290-7324-X423 A290-7324-X425 A290-7324-X423 A 2000iB/165F/170CF/125L R-2000iB/165R R-2000iB/165F/165R/100P/175L/210WE R-2000iB/185L/250F/200R/175L/210WE R-2000iB/165F/165R/100P/125L/150U R-2000iB/165F/165R/100P/125L/150U R-2000iB/165F/165R/100P/125L/150U R-2000iB/165F/165R/100P/125L/150U R-2000iB/165F/165R/100P/125L/150U R-2000iB/165F/165R/100P/125L/250F/165R/100P/125L/150U R-2000iB/165F/165R/100P/125L/150U R-2000iB/165F/165R/100P/125L/250F/100P/125L/250F/100P/125L/250F/165R/100P/125L/250F/165R/100P/125L/250F/100P/125L/250F/100P/125L/250F/100P/125L/250F/100P/125L/250F/100P/125L/250F/100P/125L/250F/100P/125L/250F/100P/125L/250F/100P/125L/250F/100P/125L/250F/100P/125L/250F/100P/125L/250F/100P/125L/250F/100P/125L/250F/100P/125L/250F/100P/125L/250F/100P/125L/250F/100P/125L/250F/100P/125L/2 /200R/100P/175L/210WE/150U/220U R-2000iB/125L R-2000iB/170CF R-2000iB/170CF R-2000iB/165CF R-200 2000iB/170CF R-2000iB/125L R-2000iB/165CF NOTE The shapes of J2- and J3-axis input gear mounting bolts have been changed in length. - The whole length of the input gear for the robots shipped in October 2006 and earlier is 92 mm. The input gear mounting bolt must be M6 65. - The whole length of the input gear for the robots shipped in November 2006 and later is 97 mm. The input gear mounting bolt must be M6 70. - 241 - A.MAINTENANCE PARTS Name Balancer Wrist unit Shaft assembly Ring Name Balancer Ring Name Balancer Wrist unit Shaft assembly Ring Name Balancer R 2000iB/165F/125L/100H A290-7329-V301 R-2000iB/210F/175L A290-7329-V302 R-2000iB/185L/250F A290-7329-V303 R-2000iB/210WE (A05B-1329-B255) A290-7329-V305 R-2000iB/210WE (A05B-1329-B256) A290-7329-V305 R-2000iB/210WE (A05B-1329-B26) A290-7329-V305 R-2000iB/210WE (A05B-1329-B26) A290-7329-V305 R-2000iB/210WE (A05B-1329-B26) A290-7329-V305 R-2000iB/210WE (A05B-1329-A290-7329-V305 R-2000iB/210WE (A05B-1329-A290-7329-V305 R-2000iB/210WE (A05B-1329-A290-7329-A290-7329-A290-7329-A290-7329-A290-7329-65F/165R/170CF/125L/150U A05B-1329-K811 for severe dust./liquid protection option and epoxy paint designation R-2000iB/210F/185L/250F/200R A05B-1329-K812 for severe dust./liquid protection option and epoxy paint designation R-2000iB/210F/185L/250F/200R A05B-1329-K814 R 2000iB/100H A290-7329-T571 R-2000iB/165CF A290-7321-T503 R-2000iB/210WE (A05B-1329-B255) A290-7329-V352 R-2000iB/210WE (A05B-1329-B255) A290-7329-V353 R-2000iB/210WE (A05B-1329-B256) A290-7329-V353 R-2000iB/210WE A290-7329-V353 R-2000iB/210WE (A05B-1329-B256) A290-7329-V359 R-2000iB/210WE (A05B-1329-B266) A290-7329-V359 R-2000iB/210WE (A05B-1329-B266) A290-7329-V359 R-2000iB/210WE (A05B-1329-B266) A290-7329-V359 A290-7329-V369 A290-7329-V369 A290-7329-V369 A290-7329-V369 A290-7329-V369 A290 4pcs per/1 robot A98L-0040-0174#14KG A98L-0040-0174#15KG A98L-0040-0174#12KG R-2000iB/165F/125L/165R/100P/100H/150U R-2000iB/165F/125L/260F/200R/210WE /175L/220U R-2000iB/165F/125L/165R/100P/100H/150U R-2000iB/165F/125L/165R/100P/100H/150U R-2000iB/165F/125L/260F/200R/210WE /175L/220U R-2000iB/165F/125L/260F/200R/210WE /175L/220U R-2000iB/165F/125L/165R/100P/100H/150U R-2000iB/165F/125L/260F/200R/210WE /175L/220U R-2000iB/165F/125L/260F/200R/210WE /175L/200R/210WE /175L/200R/210WE /175L/200R/210WE /175L/200R/210WE /175L/200R/210WE /175L/200R/210WE /175L/200R/210WE /175L/200R/210WE /175L/200R/200R/20U R-2000iB/165F/200R/20U R-2000iB/165F/200R/20U R-2000iB/165F/200R/20U R-2000iB/20U R-2000iB APPENDIX B-82235EN/08 A.MAINTENANCE PARTS Table A (j) Name Specifications O-ring JB-OR1A-G125 O-ring JB-OR1A-G125 O-ring JB-OR1A-G125 O-ring O-ring O-ring O-ring O-ring O-ring JB-OR1A-G125 O-ring JB-OR1A-G125 O-ring JB-OR1A-G125 O-ring JB-OR1A-G125 O-ring O-ring O-ring O-ring O-ring O-ring D-ring O-ring JB-OR1A-G125 O-ring JB-OR1A-G125 O-ring D-ring O-ring O-ring O-ring D-ring O-ring D-ring O-ring O-ring O-ring O-ring D-ring O-ring D-ring O-ring D-ring O-ring D-ring O-ring O-ring O-ring O-ring O-ring D-ring O-ring D-ring O-ring O-ring O-ring O-ring O-ring O-ring O-ring O-ring O-ring D-ring O-ring D-ring D-ring O-ring D-ring D-ring D-ring D-ring JB-OR4D-G280 JB-OR1A-G300 A98L-0001-0347#S265 JB-OR1A-G280 OR1A-G190 O-ring O-ring O-ring O-ring O-ring O-ring A290-7329-X896 JB-OR4D-G190 A290-7302-X552 A98L-0001-0347#S125 JB-OR1A-G115 O-ring Models J1 to J3 axis of R-2000iB/170CF J2 and J3 axis of R-2000iB/170CF J2 and J3 axis of R-2000iB/170CF J4 to J6 axis other than R-2000iB/170CF J1 and J4 to J6 axis of R-2000iB/170CF R-2000iB/170CF R-2000iB/170CF J2 and J3 axis of R-2000iB/170CF J4 to J6 axis other than R-2000iB/170CF J4 to J6 axis other than R-2000iB/170CF J2 and J3 axis of R-2000iB/170CF J4 to J6 axis other than R-2000iB/170CF J4 to J6 axis of R-2000iB/170CF J4 to J6 axis other than R-2000iB/170CF 2000iB/165F/210F/185L/250F /165R/200R/100P/170CF/210WE /125L/175L/100H /150U/ 220U R-2000iB/165F/210F/185L/250F/165R /200R/100P/170CF/125L/175L/100H /150U/ 200U R-2000iB/165F/210F/185L/250F/165R /200R/100P/170CF/125L/175L/100H /150U/ 200U R-2000iB/165F/210F/185L/250F/165R /200R/100P/170CF/125L/175L/100H /150U/ 200U R-2000iB/165F/210F/185L/250F/185L/250F/185L/250F/185U R-2000iB/165CF/210P/185L/250F/185U R /200R/100P/170CF/125L/175L/100H /150U/ 220U R-2000iB/210WE J2-axis reducer R-2000iB/165CF R-2000iB/165F/165R/100P/170CF/125L /100H/150U R-2000iB/210F/185L/250F/200R /100P/175L /220U R-2000iB/210F/185L/250F/200R /100P/175L /220U R-2000iB/210F/185L/250F/200R /100P/175L /220U R-2000iB/210WE R-2000iB/210WE R-2000iB/210F/185L/250F/200R /100P/175L /220U R-2000iB/210WE R 2000iB/210WE J4-axis reducer Wrist unit R-2000iB/165CF R-2000iB/165CF - 243 - Location J1-axis motor J4-axis motor A.MAINTENANCE PARTS APPENDIX B-82235EN/08 Table A (I) oil seal Name Specifications Oil seal A98L-0040-0181 Oil seal Oil seal Oil seal Oil seal Oil seal Oil seal A98L-0040-0237#13016014 A98L-0040-0237#13016014 A98L-0040-0306 A98L-0040-0307 Name Stopper 2 Collar Bush Bolt Washer Collar Bolt Bush Washer Stopper J2B Plate Stopper J3B Stopper 2000iB/165CF R-2000iB/210WE (A05B-1329-B256) R-2000iB/210WE (A05B-1329-B256) R-2000iB/165F/210F/185L/250F A290-7329-X215 /210WE/170CF/125L/175L/100H/150U /220U R-2000iB/165R/200R/100P A290-7329-Y215 R-2000iB/165CF A290-7329-X215 /210WE/170CF/125L/175L/100H/150U /220U R-2000iB/210WE (A05B-1329-B256) R-2000iB/210WE (A0 A290-7324-X214 R-2000iB/165F/210F/185L/250F/165R A97L-0218-0484#3125 /200R/100P/170CF/125L/175L/100H A6-BA-24X80 /150U/220U A6-WM-24S R-2000iB/210WE A97L-0218-0484#3125 A6-WM-24S R-2000iB/210WE A97L-0218-0484#3125 A6-WM-24S R-2000iB/165F/210F/185L/250F A290-7329-X341 /210WE/125L/175L/100H/150U/220U R-WM-24S R-2000iB/210WE A97L-0218-0484#3125 A6-WM-24S R-2000iB/210WE A 2000iB/165R/200R/100P A290-7329-X341 R-2000iB/165F/210F/185L/250F A290-7329-X342 R-2000iB/165F/210F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250F/185L/250 /210WE/165R/200R/100P/125L/175L /100H/150U/220U R-2000iB/165F/210F/185L/250F A290-7329-X412 /210WE/165R/200R/100P/125L/175L /100H/150U/220U R-2000iB/165V/ 2000iB/165CF Stopper J3B A290-7321-X462 R-2000iB/165CF - 244 - Location J1 to J3 axis motor J3-axis plus side For J3-axis plus side and minus side For J3-axis plus side For J3-axis minus side TableA (n) Parts name Coating bolt C washer Coating washer A97L-0218-0432#12X50 A97L-0218-0432#12X60 A97L A97L-0218-0435#M12H A97L-0218-045#M12H A97L-0218-045#M12H A97L-0218-045#M12H A97L-0218-045 pcs/1 robot J2 arm-J3-axis reducer 24 pcs/1 robot J2 base -J2-axis reducer 12 pcs/1 robot J1 stopper 1 pc/1 robot J1 stopper 4 pcs/1 robot J1 stopper 4 pcs/1 robot J2 base -J2-axis reducer 12 pcs/1 robot J1 stopper 4 pcs/1 robot J2 base -J2-axis reducer 12 pcs/1 robot J3 casing - J3-axis reducer 12 pcs/1 robot J2 base -J2-axis reducer 12 pcs/1 robot J3 casing - J3-axis reducer 12 pcs/1 robot J4/J5/J6-axis motor 3 pcs/1 robot J4/J5/J6-axis reducer 12 pcs/1 robot J4/J5/J6 robot J2 arm-J2-axis reducer 30 pcs/1 robot J3-axis reducer -J3 casing 24 pcs/1 robot J2 base - J2-axis reducer 12 pcs/1 robot J2 base - J2-axis reducer 30 pcs/1 robot J2 base - J1-axis motor 3 pcs/1 robot J2/J3-axis motor 3 pcs/1 robot J2 base - J2-axis reducer 12 pcs/1 robot J2 base - J2-axis reducer 12 pcs/1 robot J2 base - J2-axis reducer 30 pcs/1 robot J2 base - J2-axis motor 4 pcs/1 robot J2/J3-axis motor 3 pcs/1 robot J2 base - J2-axis reducer 12 pcs/1 robot J2 base - J2-axis reducer 30 pcs/1 robot J2 base - J2-axis reducer 30 pcs/1 robot J2/J3-axis motor 3 pcs/1 robot J2 base - J2-axis reducer 12 pcs/1 robot J2 base - J2-axis reducer 30 pcs/1 robot J2 base - J2-axis reducer 30 pcs/1 robot J2/J3-axis motor 3 pcs/1 robot J2 base - J2-axis reducer 30 pcs/1 robot J2 base - J2-axis reducer 30 pcs/1 robot J2/J3-axis motor 3 pcs/1 robot J2 base - J2-axis reducer 30 pcs/1 robot J2/J3-axis motor 3 pcs/1 robot J2 base - J2-axis reducer 30 pcs/1 robot J2/J3-axis motor 3 pcs/1 robot J2/J3-axis 4pcs/1 robot J4/J5/J6-axis motor 3pcs/1 robot Table A (o) Parts name Fan assembly Parts name A.MAINTENANCE PARTS APPENDIX B-82235EN/08 Specifications Fan Models R-2000iB/165F/210F/185L/250F/165R /200R/100P/125L/175L/100H/150U A290-7329-V606 Table A (p) Specifications Vernier mark seal Remarks Vernier mark seal A370-3032 0146 For all axes Vernier mark seal A370-3031-0147 For all axes Vernier mark seal A370-3031-0148 For all axes - 245 - Used locations J1/J2/J3-axis motor (for each axis) Models R-2000iB/165F /125L R-2000iB/1 5V(A1,A2,A3,A4) PRQJ1 XPRQJ1 8 9 10 11 12 13 14 RI2 RI8 RO2 RO8 5V(B1,B2,B3,B4) PRQJ2 XPRQJ2 15 16 17 18 19 20 21 G FG RI3 XPPABN RO3 22 23 24 24VF(A1,A2,A3,A4) 25 5V(C1,C2,C3,C4) 26 27 PRQJ3 28 XPRQJ3 Han 42DD (2.5SQ 10A) 29 30 31 0V(D1,D2) 32 0V(A1,A2,A3,A4) 33 PRQJ4 34 XPRQJ4 35 XHBK RI5 XROT RO5 36 37 38 39 0V(B1,B2,B3,B4) 40 41 PRQJ5 42 XPRQJ5 RI6 24VF(OT) RO6 NOTE) SDLP:SEVERE DUST/LIQUID PROTECTION 0V(C1,C2,C3,C4) PRQJ6 KPRQJ6 6V (BT1,BT2,BT3, BT4,BT5,BT6, ,BT7) + BATTERY 0V (BT1,BT2,BT3, BT4,BT5) + BATTERY unit circuit diagram (R-2000iB/165F/210F/185L/250F/165R/200R/125L/175L/150U Basic cable) - 246 - B.MECHANICAL UNIT CIRCUIT DIAGRAM APPENDIX B-82235EN/08 J4 MOTOR (aiS12/4000) J1 MOTOR (aiS12/4000) J JL04V-8A18-10SE-EB-R M1M 22-22P(8.0SQ 46A) D J1G1 A J1U1 C J1W1 B J1V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT1) 8 5V(A1) 1 5 XPRQJ1 5V(A2) 9 2 6 PRQJ1 10 0V(A1) 3 FG 0V(A2) 7 JN1FS10SL1 M1P 0V(BT4) 0V(BT1) MS3108B10SL-3S JL04V-8A10SL-3S JL04V A BK(J1) B BKC(J1) 22-22P(8.0SQ 46A) D J2G1 A J2U1 C J2W1 B J2V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT2) 8 5V(A3) 1 5 XPRQJ2 9 5V(A4) 2 6 PRQJ2 10 0V(A3) 3 FG 0V(A4) 7 M2P D J5G1 A J5U1 C J5W1 B J5V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT2) 8 5V(A3) 1 5 XPRQJ2 9 5V(A4) 2 6 PRQJ2 10 0V(A3) 3 FG 0V(A4) 7 M2P D J5G1 A J5U1 C J5W1 B J5V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT2) 8 5V(A3) 1 5 XPRQJ2 9 5V(A4) 2 6 PRQJ2 10 0V(A3) 3 FG 0V(A4) 7 M2P D J5G1 A J5U1 C J5W1 B J5V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(C1) 1 5 XPRQJ2 9 5V(A4) 2 6 PRQJ2 10 0V(A3) 3 FG 0V(A4) 7 M2P D J5G1 A J5U1 C J5W1 B J5V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(C1) 1 5 XPRQJ2 9 5V(A4) 2 6 PRQJ2 10 0V(A3) 3 FG 0V(A4) 7 M2P D J5G1 A J5U1 C J5W1 B J5V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(C1) 1 5 XPRQJ2 9 5V(A4) 2 6 PRQJ2 10 0V(A3) 3 FG 0V(A4) 7 M2P D J5G1 A J5U1 C J5W1 B J5V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(C1) 1 5 XPRQJ2 9 5V(A4) 2 6 PRQJ2 10 0V(A3) 3 FG 0V(A4) 7 M2P D J5G1 A J5U1 C J5W1 B J5V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(C1) 1 5 XPRQJ2 9 5V(A4) 2 6 PRQJ2 10 0V(A3) 3 FG 0V(A4) 7 M2P D J5G1 A J5U1 C J5W1 B J5V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(C1) 1 5 XPRQJ2 9 5V(A4) 2 6 PRQJ2 10 0V(A3) 3 FG 0V(A4) 7 M2P D J5G1 A J5U1 C J5W1 B J5V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(C1) 1 5 XPRQJ2 9 5V(A4) 7 M2P D J5G1 A J5U1 C J5W1 B J5V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(A3) 1 5 XPRQJ2 9 5V(A4) 7 M2P D J5G1 A J5U1 C J5W1 B J5V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(A3) 1 5 XPRQJ2 9 5V(A4) 7 M2P D J5G1 A J5U1 C J5W1 B J5V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(A3) 1 5 XPRQJ2 9 5V(A4) 7 M2P D J5G1 A J5U1 C J5W1 B J5V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(A3) 1 5 XPRQJ2 9 5V(A4) 7 M2P D J5G1 A J5U1 C J5W1 B J5V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(A3) 1 5 XPRQJ2 9 5V(A4) 7 M2P D J5G1 A J5U1 C J5W1 B J5V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(A3) 1 5 XPRQJ2 9 5V(A4) 7 M2P D J5G1 A J5W1 B MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R M2BK C MS3108B22-22S JL04V-8A22-22SE-EB-R M5BK MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R 10SL-3P(1.25SQ 13A) A BK(J2) B BKC(J2) C MS3108B18-10S JL04V-8A18-10SE-EB-R 22-22P(8.0SQ 46A) D J3G1 A J3U1 C J3W1 B J3V1 10SL1(0.3SQ 3A) 4 6V(BT3) 8 5V(B1) 1 5 XPRQJ3 5V(B2) 9 2 6 PRQJ3 5V(B1) 1 5 XPRQJ3 5V(B1) 3 FG 0V(B1) 3 FG 0V(B2) 7 M3P M3BK C JN1FS10SL1 10SL1(0.3SQ 3A) 4 6V(BT6) 8 5V(C3) 1 5 XPRQJ6 9 5V(C4) 2 6 PRQJ6 10 0V(C3) 3 FG 0V(C4) 7 M6P 0V(BT6) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R 10SL-3P(1.25SQ 13A) A BK(J3) B BKC(J3) E W2524F (0.5SQ 5A)\varphi 9.6-\varphi 15 4 RO4 3 RO3 2 RO2 1 RO1 9 RI1 8 0V(D1) 7 XHBK 6 RO6 5 RO5 15 RI5 14 RÍ9(XPPABN) 13 RI8 12 RI4 11 ŘI3 10 RI2 20 24VF(A4) 19 24VF(A3) 18 24VF(A2) 17 24VF(A1) 16 RÍ6 24 RI7 23 0V(D2) 22 RO8 21 RO7 for SDLP (K515, K615) 21 22 23 24 RO7 RO8 0V(D2) RI7 F TYPE 17 24VF(A1) 18 24VF(A2) 19 24VF(A3) 20 24VF(A4) G 13 14 15 16 RI8 RI9(XPPABN) RI5 RI6 9 10 11 12 RI1 RI2 RI3 RI4 5 6 7 8 RO5 RO6 XHBK 0V(D1) M6BK C 10SL-3P(1.25SQ 13A) A BK(J6) B BKC(J6) R-2000iB/165F/210F /185L/250F/125L/175L /150U J3 CONNECTOR PANEL EE A BK(J5) B BKC(J5) D J6G1 A J6U1 C J6W1 B J6V1 0V(BT3) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R 10SL-3P(1.25SQ 13A) J6 MOTOR (aiS12/4000) M6M 18-10P(8.0SQ 46A) J3 MOTOR (aiSR30/3000) M3M JN1DS10SL1 A BK(J4) B BKC(J4) J5 MOTOR (aiS12/4000) M5M 18-10P(8.0SQ 46A) MS3106B18-10S JL04V-8A18-10SE-EB-R M2M 10SL-3P(1.25SQ 13A) C J2 MOTOR (aiSR30/3000) MS3108B22-22S JL04V-8A22-22SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT4) 8 5V(B3) 1 5 XPRQJ4 9 5V(B4) 2 6 PRQJ4 10 0V(B3) 3 FG 0V(B4) 7 M4P 1 2 3 4 Han 24DD (2.5SQ 10A) RO1 RO2 RO3 RO4 NOTE) K***/K*** : Normal/CE cable MS** : Normal/CE cable MS** : Normal/CE cable MS** : Normal/CE cable MS** : K511 : K512 : K513 : K515 : A660-8015-T301 A660-8015-T301 A660-8015-T301 A660-8015-T352 A660-8015-T351 A660-8015-T351 A660-8015-T301 A660-8015-T301 A660-8015-T351 A660-8015-T351 A660-8015-T351 A660-8015-T301 A660-8015-T301 A660-8015-T351 A660-8015 BT4, BT5, BT6, ,BT7) K238 XROT1 J1OT C XROT2 NC J2OT C XROT3 C 24VF(OT) NC J3OT 24VF(OT) NC Fig. B (b) Mechanical unit circuit diagram (R-2000iB/100P Basic cable) - 248 - B.MECHANICAL UNIT CIRCUIT DIAGRAM APPENDIX B-82235EN/08 J4 MOTOR (aiS12/4000) J1 MOTOR (aiSR30/3000) MS3108B22-22S JL04V-8A22-22SE EB-R M4M 18-10P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 MS3108B18-10S JL04V-8A18-10SE-EB-R M1M 22-22P(8.0SQ 46A) D J1G1 A J1U1 C J1W1 B J1V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT1) 8 5V(A1) 1 5 XPRQJ1 9 5V(A2) 2 6 PRQJ1 10 0V(A1) 3 FG 0V(A2) 7 M1P JN1FS10SL1 10SL1(0.3SQ 3A) 4 6V(BT4) 8 5V(B3) 1 5 XPRQJ4 9 5V(B4) 2 6 PRQJ4 10 0V(B3) 3 FG 0V(B4) 7 M4P 0V(BT4) 0V(BT1) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R M1BK C JL04V-6A10 SL-3SE-EB-R 10SL-3P(1.25SQ 13A) A BK(J1) B BKC(J1) M1FAN A 200A 10SL-3P(1.25SQ 13A) B 200B C M2M 22-22P(8.0SQ 46A) D J2G1 A J2U1 C J2W1 B J2V1 JN1DS10SL1 M2P 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(C1) 1 5 XPRQJ5 9 5V(C2) 2 6 PRQJ5 10 0V(C1) 3 FG 0V(C2) 7 M5P 0V(BT5) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R M2BK C 10SL-3P(1.25SQ 13A) A BK(J2) B BKC(J2) M2FAN A 200A MS3108B18-10S JL04V-8A18-10SE-EB-R 10SL-3P(1.25SQ 13A) B 200B C JN1FS10SL1 J3 MOTOR (αiSR30/3000) MS3108B22-22S JL04V-8A22-22SE-EB-R M3M 22-22P(8.0SQ 46A) D J3G1 A J3U1 C J3W1 B J3V1 JN1DS10SL1 C M3BK K211 K212 K213 K238 K611 K612 K613 K642 10SL-3P(1.25SQ 13A) A BK(J3) B BKC(J3) M3FAN A 200A 10SL-3P(1.25SQ 13A) A BK(J5) B BKC(J5) J6 MOTOR (αiS12/4000) M6M 18-10P(8.0SQ 46A) D J6G1 A J6U1 C J6W1 B J6V1 10SL1(0.3SQ 3A) 4 6V(BT6) 8 5V(C3) 1 5 XPRQJ6 9 5V(C4) 2 6 PRQJ6 10 0V(C3) 3 FG 0V(C4) 7 M6P 0V(BT6) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT3) 8 5V(B1) 1 5 XPRQJ6 9 5V(C4) 7 M6P 0V(BT6) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT3) 8 5V(B1) 1 5 XPRQJ6 9 5V(C4) 7 M6P 0V(BT6) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT3) 8 5V(B1) 1 5 XPRQJ6 9 5V(C4) 7 M6P 0V(BT6) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT3) 8 5V(B1) 1 5 XPRQJ6 9 5V(C4) 7 M6P 0V(BT6) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT3) 8 5V(B1) 1 5 XPRQJ6 9 5V(C4) 7 M6P 0V(BT6) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT3) 8 5V(B1) 1 5 XPRQJ6 9 5V(C4) 7 M6P 0V(BT6) MS3108B10SL-3SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT3) 8 5V(B1) 1 5 XPRQJ6 9 5V(C4) 7 M6P 0V(BT6) MS3108B10SL-3SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT3) 8 5V(B1) 1 5 XPRQJ6 9 5V(C4) 7 M6P 0V(BT6) MS3108B10SL-3SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT3) 8 5V(B1) 1 5 XPRQJ6 9 5V(C4) 7 M6P 0V(BT6) MS3108B10SL-3SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT3) 8 5V(B1) 1 5 XPRQJ6 9 5V(C4) 7 M6P 0V(BT6) MS3108B10SL-3SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT6) MS3108B10SL-3 EB-R A BK(J4) B BKC(J4) D J5G1 A J5U1 C J5W1 B J5V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT2) 8 5V(A3) 1 5 XPRQJ2 9 5V(A4) 2 6 PRQJ2 10 0V(A3) 3 FG 0V(A4) 7 10SL-3P(1.25SQ 13A) J5 MOTOR (aiS12/4000) M5M 18-10P(8.0SQ 46A) MS3106B18-10S JL04V-8A18-10SE-EB-R J2 MOTOR (aiS12/4000) MS3108B22-22S JL04V-8A22-22SE-EB-R Fig. B (c) Mechanical unit circuit diagram (R-2000iB/210WE Basic cable) - 250 - APPENDIX B-82235EN/08 MS3108B22-22S JL04V-8A22-22SE-EB-R C J1W1 B J1V1 MS3108B22-22S JL04V-8A18-10SE-EB-R C J1W1 B J1V1 JN1DS10SL1 MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R MS3108B22-22S JL04V-8A22-22SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT1) 8 5V(A1) 1 5 XPRQJ1 9 5V(A2) 2 6 PRQJ1 10 0V(A1) 3 FG 0V(A2) 7 M1P 0V(BT1) M1BK C 10SL-3P(1.2SSQ 13A) J2 MOTOR (aisR30/3000) D J2G1 A J2U1 C J2W1 B J2V1 MS3106B18-10S JL04V-8A18-10SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT1) 8 5V(A1) 1 5 XPRQJ1 9 5V(A2) 2 6 PRQJ1 10 0V(A1) 3 FG 0V(A2) 7 M1P 0V(BT1) M1BK C 10SL-3P(1.2SSQ 13A) J2 MOTOR (aisR30/3000) D J2G1 A J2U1 C J2W1 B J2V1 MS3106B18-10S JL04V-8A18-10SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT1) 8 5V(A1) 1 5 XPRQJ1 9 5V(A2) 2 6 PRQJ1 10 0V(A1) 3 FG 0V(A2) 7 M1P 0V(BT1) M1BK C 10SL-3P(1.2SSQ 13A) J2 MOTOR (aisR30/3000) D J2G1 A J2U1 C J2W1 B J2V1 MS3106B18-10S JL04V-8A18-10SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT2) 8 5V(A3) 1 5 XPRQJ2 5V(A4) 9 2 6 PRQJ2 10 0V(A3) 3 FG 0V(A4) 7 M2P JN1DS10SL1 MS3108B22-22S JL04V-8Á22-22SE-EB-R M2BK C 10SL-3P(1.25SQ 13A) A BK(J2) B BKC(J2) D J3G1 A J3U1 C J3W1 B J3V1 JN1DS10SL1 MŠ3108B10SL-3S JL04V-8Á10SL-3SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT3) 8 5V(B1) 1 5 XPRQJ3 9 5V(B2) 2 6 PRQJ3 10 0V(B1) 3 FG 0V(B2) 7 M3P MS3108B18-10S JL04V-8A18-10SE-EB-R M3BK C 10SL-3P(1.25SQ 13A) A BK(J3) B BKC(J3) JN1FS10SL1 A BK(J4) B BKC(J4) J5 MOTOR (a) 15G1 A J5U1 C J5W1 B J5V1 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(C1) 1 5 XPRQJ5 2 9 5V(C2) 6 PRQJ5 10 0V(C1) 3 FG 0V(C2) 7 M5P M5BK C 10SL-3P(1.25SQ 13A) A BK(J5) B BKC(J5) 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(C1) 1 5 XPRQJ5 2 9 5V(C2) 6 PRQJ5 10 0V(C1) 3 FG 0V(C2) 7 M5P M5BK C 10SL-3P(1.25SQ 13A) A BK(J5) B BKC(J5) 10SL1(0.3SQ 3A) 4 6V(BT6) 8 5V(C3) 1 5 XPRQJ6 5V(C4) 9 2 6 PRQJ6 10 0V(C3) 3 FG 0V(C4) 7 M6P 0V(BT6) MS3108B10SL-3S JL04V-8A10SL-3S JL 3SE-EB-R M4BK J6 MOTOR (aiS12/4000) M6M 18-10P(8.0SQ 46A) J3 MOTOR (aiSR30/3000) M3M 22-22P(8.0SQ 46A) 10SL1(0.3SQ 3A) 4 6V(BT4) 8 5V(B3) 1 5 XPRQJ4 9 5V(B4) 2 6 PRQJ4 10 0V(B3) 3 FG 0V(B4) 7 M4P 0V(BT5) 0V(BT2) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R 18-10P(8.0SQ 46A) D J4G1 A J4Ú1 C J4W1 B J4V1 0V(BT4) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) JN1DS10SL1 JN1FS10SL1 M4M M6BK C 10SL-3P(1.25SQ 13A) A BK(J6) B BKC(J6) B.MECHANICAL UNIT CIRCUIT DIAGRAM APPENDIX B-82235EN/08 J1 CONNECTOR PANEL RM1 1 2 3 4 5 6 7 8 9 10 11 12 13 RP1 1 2 3 4 5 6 7 RI1 RI7 RO1 RO7 Han 42DD (2.5SQ 10A) 29 XHBK 30 31 0V(D1,D2) 32 0V(A1,A2,A3,A4) 33 PRQJ4 34 XPRQJ4 35 RI5 XROT RO5 36 37 38 39 0V(B1,B2,B3,B4) 40 41 PRQJ5 42 XPRQJ5 RI6 24VF(OT) RO6 K311/K711 or K715 (for SDLP) NOTE) SDLP: SEVERE DUST/LIQUID PROTECTION 0V(C1,C2,C3,C4) PRQJ6 6V (BT1,BT2,BT3, BT4,BT5,BT6, ,BT7) + BATTERY 0V (BT1,BT2,BT3, BT4,BT5,BT6, ,BT7) K338 XROT1 C J1OT +24E(OT) NC Fig. B (d) Mechanical unit circuit diagram (R-2000iB/170CF Basic cable) - 252 - B.MECHANICAL UNIT CIRCUIT DIAGRAM APPENDIX B-82235EN/08 J1 MOTOR (α iS8/4000) H/MS08A18-10S-DT10D1(11) H/MS08A18-10S-DT10D1(11) J4 MOTOR (α iS8/4000) M4M 18-10P(8.0SQ 46A) M1M 18-10P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 A J1G1 A J1U1 C J1W1 B J1V1 JN1DS10SL1 JN1DS10SL1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT1) 8 5V(A2) 2 6 PRQJ1 10 0V(A1) 3 FG 0V(A2) 7 M1P 0V(BT4) 0V(BT1) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R M1BK C MS3108B10SL-3SE-EB-R M1 XPRQJ2 9 5V(A4) 2 6 PRQJ2 0V(A3) 10 3 FG 0V(A4) 7 M2P M2BK C MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R 10SL-3P(1.25SQ 13A) A BK(J2) B BKC(J2) J3 MOTOR (αiSR30/3000) H/MS08A22-22S-DT12D1(11) M5P 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(C1) 1 5 XPRQJ5 9 5V(C2) 2 6 PRQJ5 10 0V(C1) 3 FG 0V(C2) 7 0V(BT5) 0V(BT2) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R H/MS08A18-10S-DT10D1(11) M3M 22-22P(8.0SQ 46A) M5BK C JN1FS10SL1 10SL1(0.3SQ 3A) 4 6V(BT3) 8 5V(B1) 1 5 XPRQJ3 9 5V(B2) 2 6 PRQJ3 0V(B1) 10 3 FG 0V(B2) 7 M3P M3BK C A BK(J3) B BKC(J3) W2524F (0.5SQ 5A) \varphi 9.6 \varphi 15 XPRQJ3 9 5V(B2) 2 6 PRQJ3 0V(B1) 10 3 FG 0V(B2) 7 M3P M3BK C A BK(J3) B BKC(J3) W2524F (0.5SQ 5A) \varphi 9.6 \varphi 15 XPRQJ3 9 5V(B2) 2 6 PRQJ3 0V(B1) 10 3 FG 0V(B2) 7 M3P M3BK C A BK(J3) B BKC(J3) W2524F (0.5SQ 5A) \varphi 9.6 \varphi 15 XPRQJ3 9 5V(B2) 2 6 PRQJ3 0V(B1) 10 3 FG 0V(B2) 7 M3P M3BK C A BK(J3) B BKC(J3) W2524F (0.5SQ 5A) \varphi 9.6 \varphi 15 XPRQJ3 9 5V(B2) 2 6 PRQJ3 0V(B1) 10 3 FG 0V(B2) 7 M3P M3BK C A BK(J3) B BKC(J3) W2524F (0.5SQ 5A) \varphi 9.6 \varphi 15 XPRQJ3 9 5V(B2) 2 6 PRQJ3 0V(B1) 10 3 FG 0V(B2) 7 M3P M3BK C A BK(J3) B BKC(J3) W2524F (0.5SQ 5A) \varphi 9.6 \varphi 15 XPRQJ3 9 5V(B2) 2 6 PRQJ3 0V(B1) 10 3 FG 0V(B2) 7 M3P M3BK C A BK(J3) B BKC(J3) W2524F (0.5SQ 5A) \varphi 9.6 \varphi 15 XPRQJ3 9 5V(B2) 2 6 PRQJ3 0V(B1) 10 3 FG 0V(B2) 7 M3P M3BK C A BK(J3) B BKC(J3) W2524F (0.5SQ 5A) \varphi 9.6 \varphi 15 XPRQJ3 9 5V(B2) 2 6 PRQJ3 0V(B1) 10 3 FG 0V(B2) 7 M3P M3BK C A BK(J3) B BKC(J3) W2524F (0.5SQ 5A) \varphi 9.6 \varphi 15 XPRQJ3 9 5V(B2) 2 6 PRQJ3 0V(B1) 10 3 FG 0V(B2) 7 M3P M3BK C A BK(J3) B BKC(J3) W2524F (0.5SQ 5A) \varphi 9.6 \varphi 15 XPRQJ3 9 5V(B2) 2 6 PRQJ3 0V(B1) 10 3 FG 0V(B2) 7 M3P M3BK C A BK(J3) B BKC(J3) W2524F (0.5SQ 5A) \varphi 9.6 \varphi 15 XPRQJ3 9 5V(B2) 7 M3P M3BK C A BK(J3) B BKC(J3) W2524F (0.5SQ 5A) \varphi 9.6 \varphi 15 XPRQJ3 9 5V(B2) 7 M3P M3BK C A BK(J3) B BKC(J3) W2524F (0.5SQ 5A) \varphi 9.6 \varphi 16 XPRQJ3 9 5V(B2) 7 M3P M3BK C A BK(J3) B BKC(J3) W2524F (0.5SQ 5A) \varphi 9.6 \varphi 16 XPRQJ3 9 5V(B2) 7 M3P M3BK C A BK(J3) B BKC(J3) W2524F (0.5SQ 5A) \varphi 9.6 \varphi 16 XPRQJ3 9 5V(B2) 7 M3P M3BK C A BK(J3) B BKC(J3) W2524F (0.5SQ 5A) \varphi 9.6 13 RI8 12 RI4 11 RI3 10 RI2 20 24VF(A4) 19 24VF(A2) 17 24VF(A1) 16 RI6 24 RI7 23 0V(D2) 22 RO8 21 RO7 for SDLP (K715) RO7 RO8 0V(D2) 17 24VF(A1) 18 24VF(A2) 19 24VF(A2) 19 24VF(A2) 19 24VF(A2) 17 24VF(A1) 16 RI6 24 RI7 23 0V(D2) 22 RO8 21 RO7 for SDLP (K715) RO7 RO8 0V(D2) RI7 F TYPE 17 24VF(A1) 16 RI6 24 RI7 23 0V(D2) 22 RO8 21 RO7 for SDLP (K715) RO7 RO8 0V(D2) 22 RO8 21 RO7 for SDLP (K715) RO7 RO8 0V(D2) RI7 F TYPE 17 24VF(A1) 18 24VF(A2) 19 2 Normal/CE cable MS** :Normal Connector JL04V** : CE Connector - 253 - M6BK C K311 K312 K313 K338 K711 K712 K713 K715 EE 21 22 23 24 10SL1(0.3SQ 3A) 4 6V(BT6) 8 5V(C3) 1 5 XPRQJ6 9 5V(C4) 2 6 PRQJ6 10 0V(C3) 3 FG 0V(C4) 7 M6P 0V(BT6) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R 10SL-3P(1.2SSQ 13A) J3 CONNECTOR PANEL EE A BK(J5) B BKC(J5) D J6G1 A J6U1 C J6W1 B J6V1 0V(BT3) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R 10SL-3P(1.25SQ 13A) J6 MOTOR (aiS8/4000) M6M 18-10P(8.0SQ 46A) D J3G1 A J3U1 C J3W1 B J3V1 JN1DS10SL1 A BK(J4) B BKC(J4) J5 MOTOR (aiS8/4000) M5M 18-10P(8.0SQ 46A) D J2G1 A J2U1 C J2W1 B J2V1 JN1DS10SL1 10SL-3P(1.25SQ 13A) J6 MOTOR (aiS8/4000) M6M 18-10P(8.0SQ 46A) D J3G1 A J3U1 C J3W1 B J3V1 JN1DS10SL1 A BK(J4) B BKC(J4) J5 MOTOR (aiS8/4000) M5M 18-10P(8.0SQ 46A) D J2G1 A J2U1 C J2W1 B J2V1 JN1DS10SL1 10SL-3P(1.25SQ 13A) J6 MOTOR (aiS8/4000) M6M 18-10P(8.0SQ 46A) D J3G1 A J3U1 C J3W1 B J3V1 JN1DS10SL1 A BK(J4) B BKC(J4) J5 MOTOR (aiS8/4000) M5M 18-10P(8.0SQ 46A) D J2G1 A J2U1 C J2W1 B J2V1 JN1DS10SL1 10SL-3P(1.25SQ 13A) J6 MOTOR (aiS8/4000) M6M 18-10P(8.0SQ 46A) D J3G1 A J3U1 C J3W1 B J3V1 JN1DS10SL1 A BK(J4) B BKC(J4) J5 MOTOR (aiS8/4000) M5M 18-10P(8.0SQ 46A) D J2G1 A J2U1 C J2W1 B J2V1 JN1DS10SL1 10SL-3P(1.25SQ 13A) J6 MOTOR (aiS8/4000) M6M 18-10P(8.0SQ 46A) D J3G1 A J3U1 C J3W1 B J3V1 JN1DS10SL1 A BK(J4) B BKC(J4) J5 MOTOR (aiS8/4000) M5M 18-10P(8.0SQ 46A) D J2G1 A J2U1 C J2W1 B J2V1 JN1DS10SL1 10SL-3P(1.25SQ 13A) J6 MOTOR (aiS8/4000) M6M 18-10P(8.0SQ 46A) D J3G1 A J3U1 C J3W1 B J3V1 JN1DS10SL1 A BK(J4) B BKC(J4) J5 MOTOR (aiS8/4000) M5M 18-10P(8.0SQ 46A) D J3G1 A J3U1 C J3W1 B J3V1 JN1DS10SL1 A BK(J4) B BKC(J4) J5 MOTOR (aiS8/4000) M5M 18-10P(8.0SQ 46A) D J3G1 A J3U1 C J3W1 B J3V1 JN1DS10SL1 A BK(J4) B BKC(J4) B BKC(13A) 1 2 3 4 Han 24DD (2.5SQ 10A) RO1 RO2 RO3 RO4 10SL-3P(1.25SQ 13A) A BK(J6) B BKC(J6) : : : : : : : : A660-8016-T659 A660-8016-T659 A660-8016-T663 A660-8016-T663 A660-8016-T663 A660-8016-T663 A660-8016-T663 A660-8016-T669 B.MECHANICAL UNIT CIRCUIT DIAGRAM APPENDIX B-82235EN/08 J1 CONNECTOR PANEL RM1 1 2 3 4 5 6 7 8 9 10 11 12 13 RP1 1 2 3 4 5 6 7 RI1 RI7 RO1 RO7 5V(A1,A2,A3,A4) PRQJ1 XPRQJ1 J1U1 J2U1 J2U1 J3U1 J3U1 J4U1 J5U1 J6U1 BK(J1) BKC(J4,J5) M TYPE 8 9 10 11 12 13 14 RI2 RI8 RO2 RO8 5V(B1,B2,B3,B4) PRQJ2 XPRQJ2 15 16 17 18 19 20 21 Han 46EE (4.0SQ 16A) M TYPE 14 15 16 17 18 19 20 21 22 23 24 25 26 27 J1OT +24E(OT) NC +24E(OT) J2OT NC +24E(OT) J3OT NC Fig. B (e) Mechanical unit circuit diagram (R-2000iB/100H Basic cable) - 254 - APPENDIX B-82235EN/08 MS3108B22-22S JL04V-8A22-22SE-EB-R B.MECHANICAL UNIT CIRCUIT DIAGRAM J4 MOTOR (aiS12/4000) J1 MOTOR (aiS12/4000) M4M 18-10P(8.0SQ 46A) MS3108B18-10S JL04V-8A22-22SE-EB-R B.MECHANICAL UNIT CIRCUIT DIAGRAM J4 MOTOR (aiS12/4000) J1 MOTOR (aiS12/4000) M4M 18-10P(8.0SQ 46A) MS3108B18-10S JL04V-8A22-22SE-EB-R B.MECHANICAL UNIT CIRCUIT DIAGRAM J4 MOTOR (aiS12/4000) J1 MOTOR (aiS12/4000) M4M 18-10P(8.0SQ 46A) MS3108B18-10S JL04V-8A22-22SE-EB-R B.MECHANICAL UNIT CIRCUIT DIAGRAM J4 MOTOR (aiS12/4000) J1 MOTOR (aiS12/4000) M4M 18-10P(8.0SQ 46A) MS3108B18-10S JL04V-8A18-10SE-EB-R M1M 22-22P(8.0SQ 46A) D J1G1 A J1U1 D J4G1 A J4U1 C J4W1 B J4V1 C J1W1 B J1V1 JN1DS10SL1 MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT4) 1 8 5V(B3) 5 XPRQJ4 2 9 5V(B4) 6 PRQJ4 3 FG 10 0V(B3) 0V(B4) 7 M4P 0V(BT4) 0V(BT1) M1BK C MS3108B22-22S JL04V-8A22-22SE-EB-R JN1FS10SL1 10SL1(0.3SQ 3A) 4 6V(BT1) 1 8 5V(A1) 5 XPRQJ1 2 9 5V(A2) 6 PRQJ1 3 FG 10 0V(A1) 0V(A2) 7 M1P 10SL-3P(1.25SQ 13A) A BK(J1) B BKC(J1) C MS3106B18-10SL-3S JL04V-8A18-10SE-EB-R MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R 0V(BT5) 10SL-3P(1.25SQ 13A) A BK(J2) B BKC(J2) J3 MOTOR (aisra0/3000) M3M 22-22P(8.0SQ 46Å) D J3G1 A J3U1 C J3W1 B J3V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT5) 1 8 5V(C1) 5 XPRQJ5 5V(C2) 2 9 6 PRQJ5 3 FG 10 0V(C1) 0V(C2) 7 M5P 0V(BT2) M2BK C MS3108B22-22S JL04V-8A22-22SE-EB-R JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT2) 1 8 5V(A3) 5 XPRQJ2 2 9 5V(A4) 6 PRQJ2 3 FG 10 0V(A4) 7 M2P A BK(J4) B BKC(J4) D J5G1 A J5U1 C J5W1 B J5V1 D J2G1 A J2U1 C J2W1 B J2V1 JN1DS10SL1 10SL-3P(1.25SQ 13A) J5 MOTOR (aiS12/4000) M5M 18-10P(8.0SQ 46A) J2 MOTOR (aiSR30/3000) M2M 22-22P(8.0SQ 46A) M4BK MS3108B10SL-3S JL04V-8A) M2M AVA 8A10SL-3SE-EB-R K116 K117 K118 K516 K517 K518 M5BK C 10SL-3P(1.25SQ 13A) A BK(J5) B BKC(J5) : A660-8016-T231 : A660-8016-T232 cable MS** :Normal Connector JL04V** : CE Connector J3 CONNECTOR PANEL EE W2524F (0.5SQ 5A) \u03c9.6-\u03c915 4 RO4 3 RO3 2 RO2 1 RO1 9 RI1 8 0V(D1) 7 XHBK 6 RO6 5 RO5 15 RI5 14 RI9(XPPABN) 13 RI8 12 RI4 11 RI3 10 RI2 20 24VF(A4) 19 24VF(A2) 17 24VF(A1) 16 RI6 24 RI7 23 0V(D2) 22 RO8 21 RO7 - 255 - B.MECHANICAL

5V(A1,A2,A3,A4) PRQJ1 XPRQJ1 24 25 26 27 28 29 30 31 32 33 J1W1 J2W1 J2W1 J2W1 J3W1 J4W1 J5W1 J6W1 BK(J3) 34 35 36 37 38 39 40 41 42 43 44 45 46 M TYPE 8 9 10 11 12 13 14 RI2 RI8 RO2 RO8 5V(B1,B2,B3,B4) PRQJ2 XPRQJ2 15 16 17 18 19 20 21 J1G1 J2G1 J2G1 J3G1 J3G1 J3G1 J4G1 J5G1 J6G1 BK(J4) BK(J5) BK(J6) G FG RI3 XPPABN RO3 22 23 24 24VF(A1,A2,A3,A4) 25 5V(C1,C2,C3,C4) 26 27 PRQJ3 28 XPRQJ3 RM2 1 2 3 4 5 6 7 8 9 10 11 12 13 J1U1 J2U1 J3U1 J3U1 J4U1 Han 46EE (4.0SQ 16A) M TYPE 14 15 16 17 18 19 20 21 22 23 J1V1 J1V1 J2V1 J3V1 J3V1 24 25 26 27 28 29 30 31 32 33 J1W1 J1W1 J2W1 J3W1 J3W1 34 35 36 37 38 39 40 41 42 43 44 45 46 J1G1 J1G1 J2G1 J2G1 J3G1 K519 Han 42DD (2.5SQ 10A) 29 XHBK 30 31 0V(D1,D2) 32 0V(A1,A2,A3,A4) 33 PRQJ4 34 XPRQJ5 42 RI6 24VF(OT) RO6 K520 0V(C1,C2,C3,C4) PRQJ6 6V (BT1,BT2,BT3, BT4,BT5,BT6, ,BT7) + BATTERY 0V (BT1,BT2,BT3,A4) 33 PRQJ4 34 XPRQJ5 42 RI6 24VF(OT) RO6 K520 0V(C1,C2,C3,C4) PRQJ6 6V (BT1,BT2,BT3, BT4,BT5,BT6, ,BT7) + BATTERY 0V (BT1,BT2,BT3,A4) 33 PRQJ4 34 XPRQJ5 42 RI6 24VF(OT) RO6 K520 0V(C1,C2,C3,C4) PRQJ6 6V (BT1,BT2,BT3,BT4,BT5,BT6, ,BT7) + BATTERY 0V (BT1,BT2,BT3,A4) 33 PRQJ4 34 XPRQJ5 42 RI6 24VF(OT) RO6 K520 0V(C1,C2,C3,C4) PRQJ6 6V (BT1,BT2,BT3,BT4,BT5,BT6, ,BT7) + BATTERY 0V (BT1,BT2,BT3,A4) A1 PRQJ5 42 RI6 24VF(OT) RO6 K520 0V(C1,C2,C3,C4) PRQJ6 6V (BT1,BT2,BT3,BT4,BT5,BT6, ,BT7) + BATTERY 0V (BT1,BT2,BT3,A4) A1 PRQJ5 42 RI6 24VF(OT) RO6 K520 0V(C1,C2,C3,C4) PRQJ6 6V (BT1,BT2,BT3,BT4,BT5,BT6, ,BT7) + BATTERY 0V (BT1,BT2,BT3,A4) A1 PRQJ5 42 RI6 24VF(OT) RO6 K520 0V(C1,C2,C3,C4) PRQJ6 6V (BT1,BT2,BT3,BT4,BT5,BT6, ,BT7) + BATTERY 0V (BT1,BT2,BT3,BT4,BT5,BT6,BT6,BT7) + BATTERY 0V (BT1,BT2,BT5) + BATTERY 0V (BT1 BT4, BT5, BT6, , BT7) - K138 K238 XROT1 J10T C XROT2 C XROT3 C Fig.B (f) NC +24E(OT) J20T M1M 22-22P(8.0SQ 46A) D J1G1 A J1U1 MS3108B18-10S JL04V-8A18-10SE-EB-R C J1W1 B J1V1 JN1DS10SL1 M1P 10SL1(0.3SQ 3A) 7 MS3108B10SL-3SE-EB-R M1BK C 0V(A2) 0V(BT1) 10SL-3P(1.25SQ 13A) J2 MOTOR (α S40/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3106B18-10S JL04V-8A22-22SE-EB-R M1BK C 0V(A2) 0V(BT1) 10SL-3P(1.25SQ 13A) J2 MOTOR (α S40/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3106B18-10S JL04V-8A22-22SE-EB-R M1BK C 0V(A2) 0V(BT1) 10SL-3P(1.25SQ 13A) J2 MOTOR (α S40/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3106B18-10S JL04V-8A22-22SE-EB-R M1BK C 0V(A2) 0V(BT1) 10SL-3P(1.25SQ 13A) J2 MOTOR (α S40/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3106B18-10S JL04V-8A22-22SE-EB-R M1BK C 0V(A2) 0V(BT1) 10SL-3P(1.25SQ 13A) J2 MOTOR (α S40/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3106B18-10S JL04V-8A22-22SE-EB-R M1BK C 0V(A2) 0V(BT1) 10SL-3P(1.25SQ 13A) J2 MOTOR (α S40/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3106B18-10S JL04V-8A22-22SE-EB-R M1BK C 0V(A2) 0V(BT1) 10SL-3P(1.25SQ 13A) J2 MOTOR (α S40/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3106B18-10S JL04V-8A22-22SE-EB-R M1BK C 0V(A2) 0V(BT1) 10SL-3P(1.25SQ 13A) J2 MOTOR (α S40/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3106B18-10S JL04V-8A22-22SE-EB-R M1BK C 0V(A2) 0V(BT1) 10SL-3P(1.25SQ 13A) J2 MOTOR (α S40/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3106B18-10S JL04V-8A22-22SE-EB-R M1BK C 0V(A2) 0V(BT1) 10SL-3P(1.25SQ 13A) J2 MOTOR (α S40/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3106B18-10S JL04V-8A22-22SE-EB-R M1BK C 0V(A2) 0V(BT1) 10SL-3P(1.25SQ 13A) J2 MOTOR (α S40/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3106B18-10S JL04V-8A22-22SE-EB-R M1BK C 0V(A2) 0V(BT1) 10SL-3P(1.25SQ 13A) J2 MOTOR (α S40/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3108B12-22SE-EB-R M1BK C 0V(A2) 0V(BT1) 10SL-3P(1.25SQ 13A) J2 MOTOR (α S40/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3108B12-22SE-EB-R M1BK C 0V(A2) 0V(BT1) 10SL-3P(1.25SQ 13A) J2 MOTOR (α S40/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3108B12-22SE-EB-R M1BK C 0V(A2) 0V(BT1) 10SL-3P(1.25SQ 13A) J2 MOTOR (α S40/4000) D J2G1 A J2W1 B J2V1 MS3108B12-22SE-EB-R M1BK C 0V(BT1) 0V(BT1) 10SL-3P(1.25SQ 13A) J2 MOTOR (α S40/4000) D J 8A18-10SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT2) 8 5V(A3) 1 5 XPRQJ2 9 5V(A4) 2 6 PRQJ2 10 0V(A3) 3 FG 0V(A4) 7 M2P JN1DS10SL1 M2BK C MS3108B22-22S JL04V-8A22-22SE-EB-R 10SL-3P(1.2SSQ 13A) A BK(J2) B BKC(J2) D J3G1 A J3U1 C J3W1 B J3V1 JN1DS10SL1 MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R 10SL1(0.3SQ 3A) 4 6V(BT3) 8 5V(B1) 1 5 XPRQJ3 9 5V(B2) 2 6 PRQJ3 10 0V(B1) 3 FG 0V(B2) 7 M3P MS3108B18-10S JL04V-8A18-10SE-EB-R M3BK C 10SL-3P(1.25SQ 13A) A BK(J3) B BKC(J3) C 10SL-3P(1.25SQ 13A) A BK(J4) B BKC(J3) C 10SL-3P(1.25SQ 13A) A BK(J3) B BKC(J4) J5 MOTOR (αiS12/4000) M5M 18-10P(8.0SQ 46A) D J5G1 A J5U1 C J5W1 B J5V1 10SL1(0.3SQ 3A) 4 6V(BT5) 8 5V(C1) 1 5 XPRQJ5 9 5V(C2) 2 6 PRQJ5 10 0V(C1) 3 FG 0V(C2) 7 M5P M5BK C 10SL-3P(1.25SQ 13A) A BK(J5) B BKC(J5) D J6G1 A J6U1 C J6W1 B J6V1 JN1FS10SL1 10SL1(0.3SQ 3A) 4 6V(BT6) 0V(C4) 7 M6P 0V(BT6) 0V(BT6 MOTOR (αiSR30/3000) M3M 22-22P(8.0SQ 46A) 10SL1(0.3SQ 3A) 4 6V(BT4) 8 5V(B3) 1 5 XPRQJ4 9 5V(B4) 2 6 PRQJ4 10 0V(B3) 3 FG 0V(B4) 7 M4P 0V(BT5) 0V(BT2) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 0V(BT4) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 0V(BT4) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 0V(BT4) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 0V(BT4) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 0V(BT4) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 0V(BT4) MS3108B10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 0V(BT4) MS3108B10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 0V(BT4) MS3108B10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 0V(BT4) MS3108B10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 0V(BT4) MS3108B10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 0V(BT4) MS3108B10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 0V(BT4) M33108B10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 0V(BT4) M33108B10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 0V(BT4) M33108B10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 0V(BT4) M33108B10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 0V(BT4) M33108B10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 A BAKAA A BKAA 22P(8.0SQ 46A) JN1DS10SL1 JN1FS10SL1 4 6V(BT1) 8 5V(A1) 1 5 XPRQJ1 9 5V(A2) 2 6 PRQJ1 10 0V(A1) 3 FG M4M MS3108B10SL-3S JL04V-8A10SL-3S JL04V RO2 1 RO1 9 RI1 8 0V(D1) 7 XHBK 6 RO6 5 RO5 15 RI5 14 RI9(XPPABN) 13 RI8 12 RI4 11 RI3 10 RI2 20 24VF(A4) 19 24VF(A3) 18 24VF(A2) 17 24VF(A1) 16 RI6 24 RI7 23 0V(D2) 22 RO8 21 RO7 NOTE) MS** : Normal Connector JL04V** : CE Connector - 257 - B.MECHANICAL UNIT CIRCUIT DIAGRAM APPENDIX B-82235EN/08 J1 CONNECTOR PANEL RM1 1 2 3 4 5 6 7 8 9 10 11 12 13 RP1 1 2 3 4 5 6 7 RI1 RI7 RO1 RO7 5V(A1,A2,A3,A4) PRQJ1 XPRQJ1 J1U1 J1U1 J2U1 J3U1 J4U1 J5U1 J6U1 BK(J1, J2, J3) BKC(J4, J5, J6) M TYPE 8 9 10 11 12 13 14 RI2 RI8 RO2 RO8 5V(B1, B2, B3, B4) PRQJ2 XPRQJ2 15 16 17 18 19 20 21 Han 46EE (4.0SQ 16A) M TYPE 14 15 16 17 18 19 20 21 Han 46EE (4.0SQ 16A) M TYPE 14 15 16 17 18 19 20 BK(J5) BK(J6) K115/K515 Han 42DD (2.5SQ 10A) 29 XHBK 30 31 0V(D1,D2) 32 0V(A1,A2,A3,A4) 33 PRQJ4 34 XPRQJ4 35 36 37 38 39 0V(B1,B2,B3,B4) 40 41 PRQJ5 42 XPRQJ5 RI5 XROT RO5 RI6 24VF(OT) RO6 K123/K523 0V(C1,C2,C3,C4) PRQJ6 6V (BT1,BT2,BT3, BT4,BT5,BT6, ,BT7) + BATTERY 0V (BT1,BT2,BT3, BT4,BT5,BT6, K282 XROT1 C XROT2 C XROT2 C XROT3 C J10T +24E(OT) J2OT NC +24E(OT) J3OT NC Fig. B (g) Mechanical unit circuit diagram (R-2000iB/165CF Basic cable) - 258 - APPENDIX B-82235EN/08 MS3108B22-22S JL04V-8A22-22SE-EB-R J1 B.MECHANICAL UNIT CIRCUIT DIAGRAM J4 MOTOR (αiS30/3000) M1M 22-22P(8.0SQ 46A) D J1G1 A J1U1 MOTOR (αiS8/4000) M4M 18-10P(8.0SQ 46A) D J4G1 A J4U1 C J4W1 B J4V1 MS3108B18-10S JL04V-8A18-10SE-EB-R C J1W1 B J1V1 JN1DS10SL1 M1BK C J2 10SL-3P(1.25SQ 13A) A BK(J2) B BKC(J2) M5BK MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R C MS3108B18-10S JL04V-8A18-10SE-EB-R C J1W1 B J1V1 JN1DS10SL1 M1BK C J2 10SL-3P(1.25SQ 13A) A BK(J2) B BKC(J2) M5BK MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R C MS3108B18-10S JL04V-8A18-10SE-EB-R C J1W1 B J1V1 JN1DS10SL1 M1BK C J2 10SL-3P(1.25SQ 13A) A BK(J2) B BKC(J2) M5BK MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R C MS3108B18-10S JL04V-8A18-10SE-EB-R C J1W1 B J1V1 JN1DS10SL1 M1BK C J2 10SL-3P(1.25SQ 13A) A BK(J2) B BKC(J2) M5BK MS3108B10SL-3SE-EB-R C MS3108B18-10S JL04V-8A18-10SE-EB-R C J1W1 B J1V1 JN1DS10SL1 M1BK C J2 10SL-3P(1.25SQ 13A) A BK(J2) B BKC(J2) M5BK MS3108B10SL-3SE-EB-R C MS3108B18-10SE-EB-R C MS3108-10SE-EB-R C MS3108B18-6V(BT3) 1 8 5V(B1) 5 XPRQJ3 2 9 5V(B2) 6 PRQJ3 3 FG 10 0V(B1) 0V(B2) 7 JN1FS10SL1 M3BK C 10SL1(0.3SQ 3A) 4 6V(BT6) 8 5V(C3) 1 5 XPRQJ6 9 5V(C4) 7 M6P 0V(BT6) 0V(BT3) MS3108B10SL-3SE-EB-R A BK(J5) B BKC(J5) D J6G1 A J6U1 C J6W1 B J6V1 D J3G1 A J3U1 C J3W1 B J3V1 M3P 10SL-3P(1.25SQ 13A) J6 MOTOR (aiS8/4000) M6M 18-10P(8.0SQ 46A) MOTOR (aiS30/3000) M3M 22-22P(8.0SQ 46A) JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT2) 0V(C1) 0V(C2) 7 M5P 0V(BT5) 0V(BT2) M2BK A BK(J4) B BKC(J4) B J5V1 JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT2) M2BK A BK(J4) B BKC(J4) B BKC(J 1 8 5V(A3) 5 XPRQJ2 2 9 5V(A4) 6 PRQJ2 3 FG 10 0V(A3) 0V(A4) 7 10SL-3P(1.25SQ 13A) J5 MOTOR (αiS8/4000) M5M 18-10P(8.0SQ 46A) MS3106B18-10SL-3SE-EB-R M4BK C MOTOR (αiS30/3000) D J2G1 A J2U1 C J2W1 B J2V1 MS3108B22-22S JL04V-8A22-22SE-EB-R MS3108B10SL-3SE-EB-R M4BK C MOTOR (αiS8/4000) M5M 18-10P(8.0SQ 46A) MS3106B18-10SL-3SE-EB-R M4BK C MOTOR (αiS8/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3108B22-22S JL04V-8A22-22SE-EB-R M53108B10SL-3SE-EB-R M4BK C MOTOR (αiS8/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3108B22-22SE-EB-R M53108B10SL-3SE-EB-R M4BK C MOTOR (αiS8/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3108B22-22SE-EB-R M53108B10SL-3SE-EB-R M4BK C MOTOR (αiS8/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3108B22-22SE-EB-R M53108B10SL-3SE-EB-R M4BK C MOTOR (αiS8/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3108B22-22SE-EB-R M53108B10SL-3SE-EB-R M4BK C MOTOR (αiS8/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3108B22-22SE-EB-R M53108B10SL-3SE-EB-R M4BK C MOTOR (αiS8/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3108B22-22SE-EB-R M53108B10SL-3SE-EB-R M4BK C MOTOR (αiS8/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3108B22-22SE-EB-R M53108B10SL-3SE-EB-R M53108B10SL-3SE-EB-R M4BK C MOTOR (αiS8/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3108B22-22SE-EB-R M53108B10SL-3SE-EB-R M4BK C MOTOR (αiS8/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3108B22-22SE-EB-R M53108B10SL-3SE-EB-R M4BK C MOTOR (αiS8/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3108B22-22SE-EB-R M53108B10SL-3SE-EB-R M4BK C M0TOR (αiS8/4000) D J2G1 A J2U1 C J2W1 B J2V1 MS3108B22-22SE-EB-R M53108B10SL-3SE-EB-R M531 JL04V-8A10SL-3SE-EB-R A BK(J1) B BKC(J1) M2M 22-22P(8.0SQ 46A) JN1DS10SL1 10SL1(0.3SQ 3A) 4 6V(BT4) 8 5V(B3) 1 5 XPRQJ4 9 5V(B4) 2 6 PRQJ4 0V(BT4) 0V(BT4) 0V(BT4) 0V(BT1) MS3108B10SL-3SE-EB-R MS3108B10SE-2SE-EB-R MS3108B10SL-3SE-EB-R MS310S 2 9 5V(A2) 6 PRQJ1 3 FG 10 0V(A1) 0V(A2) 7 M1P 10SL-3P(1.25SQ 13A) A BK(J3) B BKC(J3) MS3108B10SL-3S JL04V-8A10SL-3SE-EB-R M6BK C 10SL-3P(1.25SQ 13A) A BK(J6) B BKC(J6) J3 CONNECTOR PANEL EE W2524F (0.5SQ 5A)φ9.6-φ15 4 RO4 3 RO3 2 RO2 1 RO1 9 RI1 8 0V(D1) 7 XHBK 6 RO6 5 RO5 15 RI5 14 RI9(XPPABN) 13 RI8 12 RI4 11 RI3 10 RI2 20 24VF(A4) 19 24VF(A3) 18 24VF(A2) 17 24VF(A1) 16 RI6 24 RI7 23 0V(D2) 22 RO8 21 RO7 K115 : K523 : K523 : K515 : K515 : K523 : K515 : K515 : K523 : K515 : CIRCUIT DIAGRAM APPENDIX B-82235EN/08 J1 CONNECTOR PANEL 6V (BT1,BT2,BT3, BT4,BT5,BT6, ,BT7) TO MOTOR OF ROBOT + - USER INTERFACE POWER (OPTION) AP1 A1 A2 A3 A4 A5 K132/K532 K232/K632 K332/K732 K144/K546 Han 15D (2.5SQ 10A) F TYPE B1 P6 B2 P7 B3 P8 B4 P9 B5 P10 G G P1 P2 P3 P4 P5 C1 C2 C3 C4 C5 P11 P12 P13 P14 P15 USER INTERFACE SIGNAL (OPTION) AS1 Han 24DD (2.5SQ 10A) 17 S17 18 S18 19 S19 20 S20 21 S21 22 S22 23 S23 24 S24 F TYPE S1 S2 S3 S4 S5 S6 S7 S8 1 2 3 4 5 6 7 8 S9 S10 S11 S12 S13 S14 S15 S16 9 10 11 12 13 14 15 16 K131/K531 K231/K631 K331/K731 K143/K536 OPTION) DP1 M TYPE K135/K535 K235/K635 K335/K735 K274/K543 Han 10EE (4.0SQ 16A) NM OUTP COM COM 1 2 3 4 5 6 7 8 9 1 0 DEVICENET SIGNAL (OPTION) DS1 1 2 3 M TYPE DRAIN V+ V- 4 5 K133/K533 K233/K633 K333/K733 K273/K542 5PIN MINI CAN H CAN L K136/K536 K236/K636 K336/K736 K291/K281 I/O Unit-MODEL B INTERFACE (OPTION) I/O M TYPE 1 S 4 LVPOWER 2 + S 5 0VLOGIC 3 6 0VPOWER 24VLOGIC Han 8U (2.5SQ 10A) 7 8 FG ADDITIONAL AXIS MOTOR INTERFACE PULSECODER [2 AXES] (OPTION) ARP1 1 2 3 4 SPDJ7 XSPDJ7 PRQJ7 M TYPE 5 0V(J7A1) 6 0V(J7A2) 7 8 G FG 9 5V(J7A1) 10 5V(J7A2) 11 12 13 14 15 16 SPDJ8 5V(J8A2) 23 24 6V(BT8) (1-AXIS)(*) K139/K539 K239/K639 K339/K739 K221/K545 (2-AXIS) K151/K152 K251/K252 K351 K140/K540 K240/K640 K340/K740 K286/K544 FG (*) IN CASE OF 1-AXIS, THERE ARE ONLY PINS FOR 1-AXIS Fig. B (h) Mechanical unit circuit diagram (R-P4 P5 B1 B2 B3 B4 B5 G P6 P7 P8 P9 P10 G Han 15D (2.5SQ 10 C1 A)P11 C2 P12 C3 P13 C4 P14 C5 P15 K131 : K132 : K135 : K136 : K136 : K533 : K535 : K536 : K539 : K540 : USER INTERFACE SIGNAL (OPTION) AS2 F TYPE S1 S2 S3 S4 S5 S6 S7 S8 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 S9 S10 S11 S12 S13 S14 S15 S16 17 18 19 20 21 22 23 24 Han 24DD (2.5SQ 10A) S17 S18 S19 S20 S21 S22 S23 S24 DEVICENET POWER (OPTION) 1 2 COM COM 3 4 OUTP NM K231 : K232 : K233 : MINI 4 CAN H 5 CAN L DRAIN V+ V- I/O Unit-MODEL B INTERFACE (OPTION) I/O W2516F (1.25SQ 10A) 49.6-415 13 7 1 24VLOGIC 14 S+ 8 2 LVSIGNAL 9 15 FG 3 0VLOGIC SIGNAL 0V 16 S10 4 11 5 12 6 ADDITIONAL AXIS MOTOR INTERFACE PULSECODER [2 AXES] (OPTION) ARP2 F TYPE 21 5V(J8A1) 22 5V(J8A2) 23 24 17 0V(J8A1) 18 0V(J8A2) 19 20 G FG 13 14 15 16 SPDJ8 XSPDJ8 PRQJ8 XPRQJ8 9 5V(J7A1) 10 5V(J7A2) 11 12 6V(BT7) 5 0V(J7A1) 6 0V(J7A2) 7 8 0V(BT7) 1 2 3 4 Han 24DD (2.5SQ 10A) SPDJ7 XSPDJ7 PRQJ7 XPRQJ7 ADDITIONAL AXIS MOTOR INTERFACE POWER, BRAKE [1 AXIS] (OPTION) ARM2 C1 C2 C3 C4 C5 F TYPE J8U1 J8V1 J8W1 J8G1 B1 B2 B3 B4 B5 G K544 : A660-8014-T362 R-2000iB/165R/200R /100P F TYPE 4PIN MINI DP3 A660-8015-T612 A660-8015-T61 D008 A660-8015-T859 A660-8015-T859 A660-8016-T553 K331 : A660-8016-T555 K340 : A660-8016-T555 K333 : A660-8016-T553 K333 : A660-8016-T555 K340 : A660-8016-T555 K340 : A660-8016-T555 K333 : A660-8016-T555 K333 : A660-8016-T555 K334 : A660-8016-T555 K340 : A660-8016 K735: A660-8016-T559 K736: A05B-1329-D049 K739: A660-8016-T560 K740: A660-8016-T561 NOTE) K***/K***: Normal/CE cable J2 CONNECTOR PANEL DEVICENET POWER (OPTION) DP2 1 2 F TYPE COM COM 3 4 4PIN MINI OUTP NM DEVICENET SIGNAL (OPTION) DS2 1 2 3 F TYPE DRAIN V+ V- 4 5 5PIN MINI CAN H CAN L - 261 -C.PERIODIC MAINTENANCE TABLE C APPENDIX B-82235EN/08 PERIODIC MAINTENANCE TABLE FANUC Robot R-2000iB/165F/165R/125L/150U Working time (H) Items 1 2 3 4 5 6 7 Mechanical unit 8 Check for external damage or peeling paint Check damages of the cable protection sheaths Check wear debris of the balancer and the J1-axis dust $0.1H - \bigcirc \bigcirc \bigcirc 0.1H - \bigcirc \bigcirc \bigcirc 0.1H - \bigcirc \bigcirc \bigcirc 0.1H - 0.0 \bigcirc 12$ Check the fan (option) $0.1H - \bigcirc \bigcirc \bigcirc 13$ Greasing to balancer bush *1 0.1H - 15 16 17 18 19 Replacing grease of J2-axis reducer *1 Replacing grease of J2-axis reducer *1 Replacing grease of J4-axis gearbox *1 Replacing grease of reducer (J5/J6-axis) for wrist axis *1 1.0H 0.5H 0.5H 0.5H 1.0H • 5500m 1 3500m 1 2500m 1 3500m 1 2500m 1 3500m 1 2500m 1 3200m 1 19 18 17 1 13 16 15 Position of grease nipple Controller Replacing cable of 23 mechanical unit * 4.0H - 24 Cleaning the ventilator Check the robot cable, teach 25 pendant cable and robot connecting cable 0.2H - 0.2H C.PERIODIC MAINTENANCE TABLE 4 5 6 7 8 3 years y C.PERIODIC MAINTENANCE TABLE APPENDIX B-82235EN/08 FANUC Robot R-2000iB/210F/185L/250F/200R/175L/220U Periodic Maintenance Table Working time (H) Items Check damages 2 of the cable protection sheaths Check wear debris of the 3 balancer and the J1-axis swing stopper 3 6 9 1 Grease 0.1H - O O O 0.1H - O O O 13 Greasing to balancer bush *1 0.1H 10cml each • 14 Replacing battery *1 0.1H - 1.0H 5500ml 0.5H 3500ml 1 4 Check the mechanical unit 5 cable (Damaged or twisted) Check the end effector (hand) 6 cable Check the motor connector. 7 (Loosening) 8 Tighten the end effector bolt Mechanical unit 5 cable (Damaged or twisted) Check the end effector (hand) 6 cable Check the motor connector. 7 (Loosening) 8 Tighten the end effector bolt Mechanical unit 5 cable (Damaged or twisted) Check the end effector (hand) 6 cable Check the motor connector. 7 (Loosening) 8 Tighten the end effector bolt Mechanical unit 5 cable (Damaged or twisted) Check the motor connector. 7 (Loosening) 8 Tighten the end effector bolt Mechanical unit 5 cable (Damaged or twisted) Check the motor connector. 7 (Loosening) 8 Tighten the end effector bolt Mechanical unit 5 cable (Damaged or twisted) Check the end effector (hand) 6 cable Check the motor connector. 7 (Loosening) 8 Tighten the end effector bolt Mechanical unit 5 cable (Damaged or twisted) Check the end effector (hand) 6 cable Check the motor connector. 7 (Loosening) 8 Tighten the end effector bolt Mechanical unit 5 cable (Damaged or twisted) Check the end effector (hand) 6 cable Check the motor connector. 7 (Loosening) 8 Tighten the end effector bolt Mechanical unit 5 cable (Damaged or twisted) Check the end effector (hand) 6 cable Check the motor connector. 7 (Loosening) 8 Tighten the end effector bolt Mechanical unit 5 cable (Damaged or twisted) Check the end effector (hand) 6 cable Check the end effector (hand) 6 ca Check time Tighten the cover and main 9 bolt Check the mechanical 10 stopper and adjustable mechanical stopper Clean spatters, sawdust and 11 dust 12 Check the fan (option) 15 16 17 18 19 Replacing grease of J1-axis reducer *1 Replacing grease of J2-axis reducer *1 Replacing grease of J2-axis reducer *1 Replacing grease of J4-axis gearbox *1 Replacing grease of reducer (J5/J6-axis) for wrist axis *1 0.5H 2640ml 0.5H 1900ml 1.0H 4900ml 1.0H 49 MAINTENANCE TABLE 8 7 6 5 4 3 years Greasing to balancer bush *1 0.1H 10cml each \bullet 0.5H 2640ml \bullet 0.5H 2640ml Cleaning the ventilator 0.2H — Check the robot cable, teach 25 pendant cable and robot connecting cable 0.2H — 26 Replacing battery *1 0.1H — 1 2 3 5 6 Check for external damage or peeling paint Check damages of the cable protection sheaths Check wear debris of the balancer and the J1-axis swing stopper Check the mechanical unit cable. (Damaged or twisted) Check the motor connector. (Loosening) 7 Tighten the end effector bolt. 8 9 Mechanical unit 4800 2 years 7680 1 9 6 3 First check time Items 10 11 Tighten the cover and main bolt. Check the mechanical stopper and adjustable mechanical stopper Clean spatters, sawdust and dust Check the end effector (hand) cable Replacing grease of J1-axis 15 reducer *2 Replacing grease of J2-axis 16 reducer *2 Replacing grease of J2-axis 16 reducer *2 Replacing grease of J4-axis Controller Periodic Maintenance Table 8640 9600 10560 asterisk (*), refer to this manual or Chapter 7 of MAINTENANCE of Control Maintenance Manual. •: Requires order of parts - 266 - APPENDIX B-82235EN/08 C.PERIODIC MAINTENANCE TABLE 8 7 6 5 4 3 years 4900ml \odot \odot Working time (H) 1 9 6 3 First check months damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damage or peeling paint Check damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damage or peeling paint Check damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damage or peeling paint Check damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damage or peeling paint Check damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damage or peeling paint Check damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damage or peeling paint Check damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damage or peeling paint Check damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damage or peeling paint Check damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damage or peeling paint Check damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damage or peeling paint Check damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damages of the cable protection (Loosening) Items 1 2 3 4 Check for external damages of the cable protection (Loosening) Items 1 2 3 4 Check for sheaths Check wear debris of the balancer and the J1-axis swing stopper Check for water Check the mechanical unit 6 7 Tighten the end effector bolt. Tighten the end effector bolt. Tighten the cover and main 8 bolt. Check the mechanical stopper Mechanical unit 9 and adjustable mechanical stopper Check for water Check the end effector (hand) 11 cable 12 Check the fan (option) 15 16 17 18 19 Replacing grease of J1-axis reducer *2 Replacing grease of J2-axis reducer *2 Replacing grease of J4-axis reducer *2 Replacing grease of J3-axis reducer *2 Replacing grease of J4-axis reducer *2 Replacing grease of Manual.

Requires order of parts
Does not require order of parts - 268 - APPENDIX B-82235EN/08 C.PERIODIC MAINTENANCE TABLE 8 7 6 5 4 3 years check months months months months wear 1920 2880 3840 960 320 Check time Grease amount $0.1H - \bigcirc \bigcirc \bigcirc 0.1H - \bigcirc \bigcirc \bigcirc 0.2H - \bigcirc \bigcirc \bigcirc 0.2H - \bigcirc \bigcirc \bigcirc 0.2H - \bigcirc \bigcirc \bigcirc 0.1H - \bigcirc \bigcirc \bigcirc 0.1H - \bigcirc \bigcirc \bigcirc 0.1H - \bigcirc \bigcirc \bigcirc 0.2H - \bigcirc \bigcirc 0.2H - \bigcirc \bigcirc 0.2H - \bigcirc \bigcirc 0.2H - \bigcirc \bigcirc 0.2H - \bigcirc \bigcirc \bigcirc 0.2H - \bigcirc \bigcirc \bigcirc 0.2H - \bigcirc 0.2H - \bigcirc 0.2H - \bigcirc \bigcirc 0.2H - 0.2H - \bigcirc 0.2H - 0$ 3200ml 0.5H 340ml Items Check for external 1 damage or peeling paint Check the motor connector. (Loosening) 7 Tighten the end effector bolt. Tighten the cover and main 8 bolt. Mechanical unit Periodic Maintenance Table Check the mechanical stopper 9 and adjustable mechanical stopper Clean spatters, sawdust and 10 dust Check the end effector (hand) 11 cable 14 Replacing grease of J2-axis reducer Replacing grease of J2-axis reducer 16 17 18 19 20 Replacing grease of J2-axis reducer 16 17 18 19 20 Replacing grease of J2-axis reducer Replacing grease of J2-axis reducer 16 17 18 19 20 Replacing grease of J2-axis reducer 16 17 18 19 20 Replacing grease of J2-axis reducer R ○ connecting cable ○ ○ ○ For descriptions about the items marked with an asterisk (*), refer to this manual or Chapter 7 of MAINTENANCE of Control Maintenance Manual. ●: Requires order of parts ○: Does not require order of parts - 270 - APPENDIX B-82235EN/08 C.PERIODIC MAINTENANCE TABLE 8 7 6 5 4 3 years Working time (H) Check time Check for external damage or peeling paint Check damages 2 of the cable protection sheaths Check months months months months months months dear advised and the J1-axis swing stopper 3 6 9 1 First Grease check months mon Replacing battery. 0.1H — • 1.0H 5500ml 0.5H 2500ml 0. adjustable mechanical stopper Clean spatters, sawdust and 11 dust 12 Check the fan (option) 15 16 17 18 19 Replacing grease of J1-axis reducer Replacing grease of J2-axis reducer Replacing grease of J3-axis reducer Replacing grease of J4-axis red Controller Replacing cable of mechanical 23 unit 4.0H - 24 Cleaning the ventilator Check the robot cable, teach 25 pendant cable and robot connecting cable of mechanical 23 unit 4.0H - 24 Cleaning the ventilator Check the robot cable, teach 25 pendant cable and robot connecting cable of mechanical 23 unit 4.0H - 24 Cleaning the ventilator Check the robot cable, teach 25 pendant cable and robot cable, teach 25 pendant cable and robot ca of Control Maintenance Manual. •: Requires order of parts - 272 - APPENDIX B-82235EN/08 C.PERIODIC MAINTENANCE TABLE 8 7 6 5 4 3 years yea 0 0 1 9 6 3 First check months battery. 0.1H — 1.0H 4100ml 0.5H 2600ml 0.5H 1600ml 1.0H 400ml 15 0.5H 3950ml 16 Items 1 2 3 4 5 6 Check for external damage or peeling paint Check the mechanical cable. (Damaged or twisted) Check the motor connector. (Loosening) 7 Tighten the end effector bolt. 8 9 Mechanical unit Periodic Maintenance Table 15 16 17 18 21 Tighten the cover and main bolt. Check the mechanical stopper and adjustable mechanical stopper Replacing grease of J1-axis reducer Replacing grease of J2-axis reducer Replacing grease of J3-axis reducer Replaci reducer (J6) Replacing grease of J4-axis gearbox (J4/J5-axis) for wrist axis 8640 9600 10560 • 18 21 17 Controller Position of grease nipple Replacing the ventilator 0.2H — Check the robot cable, teach 25 pendant cable and robot connecting cable 0.2H — 26 Replacing battery *1 0.1H — $\bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc$ O O O O O O For descriptions about the items marked with an asterisk (*), refer to this manual or Chapter 7 of MAINTENANCE of Control Maintenance Manual. •: Requires order of parts - 274 - APPENDIX B-82235EN/08 C.PERIODIC MAINTENANCE TABLE 8 7 6 5 4 3 years LIST NOTE When applying LOCTITE to a part, spread the LOCTITE on the entire length area of the engaging part of the female threads, poor adhesion can occur potentially loosening the bolt. Clean the bolts and the threaded holes and wipe off the oil on the engaging section. Make sure that there is no solvent left in the threaded holes. In this case, remove all the excess LOCTITE when you are finished screwing the bolts into the threaded holes. Adopt following strength bolts. Comply with any bolt specification instructions as specified. Hexagon socket head bolt made by steel: Size M22 or less : Tensile strength 1200N/mm2 or more Size M24 or more : Tensile strength 1000N/mm2 or more All size plating bolt : Tensile strength 1000N/mm2 or more Refer to the following tables if the bolts tightening torque are not specified. Recommended bolt tightening torques Unit: Nm Hexagon socket head button bolt Hexagon socket head Hexagon socket head bolt flush bolt bolt (stainless) Nominal (Steel) Low-head bolt diameter (steel) Tightening torque Tightening t ____ (M18) 380 260 160 110 _____ M20 530 370 230 160 _____ 1.8 1.3 M5 7.9 5.6 3.4 2.5 4.0 2.8 M6 14 9.6 5.8 4.1 7.9 5.6 M8 32 23 14 9.8 14 9.6 M10 66 46 27 19 32 23 — M12 110 78 48 33 — M16 270 190 120 82 — - (M14) 180 130 76 53 -(M22) 730 510 – M36 3200 2300 - 276 - Hexagon bolt (steel) Tightening torque Upper limit Lower limit — — — 1.7 1.2 3.2 2.3 5.5 3.8 13 9.3 26 19 45 31 73 51 98 69 140 96 190 - M24 930 650 -- (M27) 1400 960 · – M30 1800 1300 -. 200 Replacement Procedure (R-2000iB/165F/210F/185L/250F/125L /175L/100H/150U/220U) 130 - INDEX B-82235EN/08 INDEX Replacement Procedure (R-2000iB/165CF)... 166 Replacement Procedure (R-2000iB/165R/200R/100P) 176 Replacement Procedure (R-2000iB/170CF). 185 Replacement Procedure (R-2000iB/210WE) 192 Replacing Cable Protection Sheaths 231 REPLACING CABLES . 139 Replacing Motor Covers **REPLACING PARTS ..** . 121 REPLACING THE BATTERIES (1.5-YEAR (5760 HOURS) PERIODIC MAINTENANCE) ... 17 REPLACING THE FANS . 120 REPLACING THE GREASE OF THE DRIVE MECHANISM (3-YEAR (11520 HOURS) PERIODIC MAINTENANCE) 20 REPLACING THE J1-AXIS MOTOR (M1) AND REDUCER . 57 REPLACING THE J2-AXIS MOTOR (M2) AND REDUCER . 110 RESETTING ALARMS AND PREPARING FOR 78 REPLACING THE [3-AXIS MOTOR (M3), GEARBOX, AND REDUCER. . 92 REPLACING THE WRIST AXIS MOTORS (M4, M5, AND M6), WRIST UNIT, AND J4 AXIS REDUCER MASTERING 37 CABLE FORMING 140 Check of Fixed Mechanical Stopper and Adjustable Mechanical . 212 BACKLASH MEASUREMENT . 147 CABLE REPLACEMENT .. . 166 CABLE WIRING 9 CHECK POINTS . . 5 Check the Mechanical Unit Cables and Connectors 7 CHECKS AND MAINTENANCE . . 1 Configuration of the Severe Dust/Liquid Protection Package. . 230 Confirm There is No Stopper Breakage on Purge Piping (Only R-2000iB/210WE) 10 Confirmation of Oil Seepage... 5 Confirmation of the Air Control Set or Air Purge Kit 6 Daily Checks 1 FIGURE OF DRIVE MECHANISM . . 51 FIXTURE POSITION MASTER . 213 GREASING THE BALANCER BUSH (1-YEAR (3840 HOURS) PERIODIC MAINTENANCE)... .. 237 MAINTENANCE TOOLS 11 MASTERING 211 MECHANICAL UNIT CIRCUIT DIAGRAM. .. 246 SAFETY PRECAUTIONS . .. s-1 SEALANT APPLICATION . .. 131 Severe Dust/Liquid Protection Characteristics... 229 SEVERE DUST/LIQUID PROTECTION PACKAGE229 SEVERE DUST/LIQUID PROTECTION PACKAGE (OPTION) 55 Notes on Specifying Severe Dust/Liquid Protection Package... .. 29 OVERVIEW . 229 STRENGTH OF BOLT AND BOLT TORQUE LIST 276 NOTE FOR PART REPLACEMENT .. . 231 TROUBLESHOOTING 262 PREFACE 2 PERIODIC MAINTENANCE 1,16 PERIODIC MAINTENANCE TABLE. ... p-1 PROCEDURE FOR 211 VERIFYING MASTERING 228 Periodic Checks and Maintenance ... 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