ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

**Artisan Technology Group**
(217) 352-9330 | sales@artisantg.com | artisantg.com

**Full-service, independent repair center**
with experienced engineers and technicians on staff.

**We buy your excess, underutilized, and idle equipment**
along with credit for buybacks and trade-ins.

**Custom engineering**
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

**Expert team | Trust guarantee | 100% satisfaction**

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *OMRON / Adept Technology XY-HRS 025-M201* at our website: *Click HERE*

NSK

# Robot Modules System

- Module Main Unit
- EXC Controller

# User's Manual 3

## = Maintenance =


1 Product Description and Installation

1. Introduction
2. Safety Precautions
3. System Configuration
4. Reference Number · Name of the Parts
5. Specifications and Dimensions
6. Transportation, Storage and Unpacking
7. Installation
8. Assembly
9. Wiring
10. Start Up
11. Initial Setting
12. Trial Running

2 Programming and Operation

13. Programming
14. Operation
15. Remote Control Operation
16. Pulse Train Output Function and Operation
17. Memory Card Specifications and Operation

3 Maintenance

18. Protection and Safety
19. Maintenance and checking
20. Alarms
21. Trouble Shooting

Appendix

Appendix 1: CN5 Encoder and Over Travel Sensor Connector
Appendix 2: CN2 Motor and Brake Connector
Appendix 3: Wiring for Remote Control
Appendix 4: Regeneration Processing



**NSK Ltd.**

**Precision Machinery & Parts Technology Centre**

**Mechatronics Product Engineering Dept.**



**Document Number: K20012-01**



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## Limited Warranty

NSK Ltd. warrants its products to be free from defects in material and/or workmanship which NSK Ltd. is notified of in writing within, which comes first, one (1) year of shipment or 2400 total operation hours. NSK Ltd., at its option, and with transportation charges prepaid by the claimant, will repair or replace any product which has been proved to the satisfaction of NSK Ltd. to have a defect in material and/or workmanship.

This warranty is the sole and exclusive remedy available, and under no circumstances shall NSK Ltd. be liable for any consequential damages, loss of profits and/or personal injury as a result of claim arising under this limited warranty. NSK Ltd. makes no other warranty express or implied, and disclaims any warranties for fitness for a particular purpose or merchantability.

## Maintenance - Introduction

- This is [3] Maintenance of the instruction manual for the robot module system.
- This part of the instruction manual describes protection and safety, maintenance and check, and alarm and troubleshooting.
- The Appendices include description of motor brake connector, encoder connector, remote control connector and regeneration.
- Be sure to read the other two parts:
  - [1] Product Description and Installation
  - [2] Programming and Operation

Copyright 1996 by NSK Ltd., Tokyo, Japan

All rights reserved.

No part of this publication may be reproduced in any form or by any means without permission in writing from NSK Ltd.

NSK Ltd. reserves the right to make changes to any products herein to improve reliability, function or design without prior notice and without any obligation.

NSK Ltd. does not assume any liability arising out of the application or use of any product described herein; neither does it convey any licence under its present patent nor the rights of others.

Patents issued and patents pending.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Contents


18. Protection and Safety ---------- 18-1
18.1. Guard Fence ---------- 18-1
18.2. Power Shut off and Restart after Power Shut off ---- 18-1
18.3. Protection and Safety Function ---------- 18-2
18.3.1. Emergency Stop ---------- 18-2
18.3.1.1. Emergency Stop State ---------- 18-2
18.3.1.2. Method of Emergency Stop ---------- 18-2
18.3.1.3. Resetting Emergency Stop State --- 18-3
18.3.1.4. Emergency Stop Circuitry ---------- 18-3
18.3.2. Brake Control ---------- 18-4
18.3.3. Over Travel Detection ---------- 18-5
18.3.4. Excessive Position Error Detection -------- 18-6
18.3.5. Software Thermal Protection ---------- 18-6
18.3.6. Protection against CPU Runaway --------- 18-6

19. Maintenance and Checking ---------- 19-1
19.1. Maintenance ---------- 19-1
19.2. Periodical Check ---------- 19-1
19.2.1. Robot Module Main Units and Cables ---- 19-1
19.2.1.1. Weekly Check ---------- 19-1
19.2.1.2. Replenishing Grease ---------- 19-2
19.2.1.3. Changing S Module Timing Belt ---- 19-4
19.2.2. EXC Controller ---------- 19-4
19.2.2.1. Periodical Check ---------- 19-4
19.2.2.2. Periodical Replacement ---------- 19-5
19.3. Warranty Period and Range ---------- 19-9
19.3.1. Warranty Period ---------- 19-9
19.3.2. Range of Warranty ---------- 19-9
19.3.3. Immunities ---------- 19-9
19.3.4. Service Fee ---------- 19-9

20. Alarms ---------- 20-1
20.1. Alarm Indication ---------- 20-1
20.1.1. CN2 Output ---------- 20-1
20.1.2. Seven Segment LED ---------- 20-1
20.1.3. Display on Teaching Box ---------- 20-2
20.1.4. Display in Remote Control Mode ---------- 20-2
20.2. Motor Condition in Case of Alarms ---------- 20-3
20.3. Alarm List ---------- 20-3
20.3.1. Normal State ---------- 20-3
20.3.2. Alarm List ---------- 20-4
20.4. Description of Alarms ---------- 20-6
20.4.1. Overheat ---------- 20-7
20.4.2. Abnormal Main Power Voltage ---------- 20-8
20.4.3. Overcurrent ---------- 20-9
20.4.4. Low Control Power Voltage ---------- 20-9
20.4.5. Power Amplifier Abnormal ---------- 20-10
20.4.6. Encoder Disconnection ---------- 20-10
20.4.7. Overload (Software Thermal Protection) - 20-11
20.4.8. Memory Error 1 ---------- 20-11
20.4.9. Memory Error 2 ---------- 20-12
20.4.10. Low Battery Voltage ---------- 20-12
20.4.11. CPU Error ---------- 20-13
20.4.12. System Mismatch ---------- 20-14
20.4.13. Excessive Position Error ---------- 20-14
20.4.14. Software Travel Limit ---------- 20-15
20.4.15. Hardware Travel Limit ---------- 20-15
20.4.16. Emergency Stop ---------- 20-16
20.4.17. Program Error ---------- 20-17
20.4.18. Home Return Error in Pulse Train Output -- 20-19
20.4.19. Alarms of Pulse Train Output ---------- 20-20
20.5. Alarm Reset Function ---------- 20-21
20.5.1. Resetting Alarms in External Operation Mode (Operation Mode by CN2 Control I/O) --- 20-22
20.5.2. Resetting Alarms in Teaching Box Operation Mode ---------- 20-22
20.5.3. Resetting Alarms in Remote Operation Mode (RS-232C Communication Mode) --------- 20-22




Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

21. Trouble Shooting ---------- 21-1
21.1. Description of Trouble Shooting ---------- 21-1
21.1.1. Runaway ---------- 21-3
21.1.2. Unit does not Run Entirely ---------- 21-4
21.1.3. Home Return does not Work Properly ---- 21-8
21.1.4. Program Operation can not be Executed Properly ---------- 21-11
21.1.5. Large Noise, Vibration and Overshoot --- 21-15
21.1.6. Does not Run Smoothly ---------- 21-16
21.1.7. Can not Release Brake ---------- 21-17
21.1.8. Unable to Reset Emergency Stop -------- 21-18
21.1.9. Overtravel Limit Abnormal ---------- 21-19
21.1.10. No Communication in Remote Control Mode ---------- 21-21
21.1.11. Program Disappears ---------- 21-22
21.1.12. Gets Heated ---------- 21-23
21.1.13. Blown Fuse ---------- 21-24
21.2. Checking Procedures in Trouble Shooting ---- 21-25
21.2.1. Checking Servo Lock State ---------- 21-26
21.2.2. Checking Brake Control Function --------- 21-27
21.2.3. Checking Back Drive Force of Mechanism ---------- 21-28
21.2.4. Determining Defective Encoder Signal. - 21-29
21.2.5. Action for Runaway and Collisions ------- 21-30
21.3. Confirming Memory Initialize and Software Version ---------- 21-31
21.3.1. Initializing Memory ---------- 21-31
21.3.2. Checking Software Version ---------- 21-33
21.4. Monitor Function ---------- 21-34
21.4.1. Analog Monitor ---------- 21-34
21.4.2. Control I/O Monitor and Releasing Brake - 21-36
21.4.2.1. Control I/O Monitor ---------- 21-36
21.4.2.2. Manually Releasing Brake ---------- 21-36
21.4.2.3. Procedures of Monitoring Control I/O and Releasing Brake ---------- 21-37
21.4.3. General I/O Monitor ---------- 21-38
21.4.4. Limit Sensor Input Monitor ---------- 21-39
21.4.5. Monitoring Programmed Operation ------- 21-40
21.4.5.1. Monitoring Function of Programmed Operation in Teaching Box Control Mode ---------- 21-40
21.4.5.2. Monitoring Function of Programmed Operation in External Control Mode ---------- 21-41

Appendix ---------- A-1
Appendix 1: ---------- A-1
Appendix 2 : ---------- A-4
Appendix 3 : ---------- A-7
Appendix 4: ---------- A-9


Artisan Technology Group - Quality Instrumentation Guaranteed | (888) 88-SOURCE | www.artisantg.com

18. Protection and Safety

19. Maintenance and checking

20. Alarms

21. Trouble Shooting

Appendix



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

(Blank page)



Artisan Technology Group - Quality Instrumentation Guaranteed | (888) 88-SOURCE | www.artisantg.com

# 18. Protection and Safety

## 18.1. Guard Fence

- Install guard fences to prevent entry of persons during operation of the robot.

Danger : *Any person in the robot module working area may be crushed by or caught in the robot module when the module main unit or the EXC controller fails or functions improperly. Such a hazard exists even when the system is running normally at a high speed.*

① For safety in daily operation, install guard fences and take action to prevent entry of persons into the robot working area.

② When you must enter the area bound by the guard fences to adjust or teach the system, keep off the robot working area and stand in a place where you can see the motion of the robot module clearly. The moving speed at this time should be lower than the safety speed (250 mm/s).

* The jogging and teaching speed are set at 50 mm/s initially.

## 18.2. Power Shut off and Restart after Power Shut off

- When power supply is interrupted due to failure of power equipment, etc., the EXC controller will stop operation, and programmed operation is discontinued.

Caution : *The servo is turned off if power is shut off during operation of the system. In this case, the slider (the main unit in the case of move of main unit) may run by inertia. This does not occur, however, to the axes provided with a brake.*

- Even if the power resets automatically, the programmed operation will not restart automatically. The normal start up procedure must be followed. When the system restarts, the program starts from the beginning. You may not resume the program halfway.

Caution : *An unexpected system malfunction may result if a higher level controller (controller to control the EXC controller such as a sequencer; to be supplied by the customer) does not detect interrupted power and continues supplying operating commands.*

→ When power is shut off to the EXC controller, the DRDY output of the control I/O (CN2) of the EXC controller is opened (which is an alarm state). Be sure to monitor the DRDY output on the higher level controller and stop giving commands when the DRDY output is opened.

○ When power recovers and the DRDY output is closed, remove the errors resulting from the interruption of the programmed operation, and then start the system from the beginning.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# 18.3. Protection and Safety Function

## 18.3.1. Emergency Stop

- When the emergency stop is established, electric current to the motor is shut off and all operations are stopped in case the robot module malfunctions.

### 18.3.1.1. Emergency Stop State

- All operation commands are canceled, and the motor is in the servo off state.
- The general outputs will keep their state before the emergency stop until power is shut off or they are changed by the OUT command.
- The data register and internal registers such as palletizing register are reset.
- Indication
  - ①Front panel LED : OF-04
  - ②CN2 control output : DRDY — Open, WRN — Open
  - ③Teaching box indicator : EMST

*Caution : Dynamic brakes (or regenerative brakes) are not built in the system. In an emergency stop, the motor is in the servo off state and the sliders (the main unit in the case of move of main unit) may run by inertia. This does not occur, however, to the axes provided with a brake.*

### 18.3.1.2. Method of Emergency Stop

- There are three methods of emergency stop. An emergency stop state occurs with any one of these methods.

(1) Press the emergency stop button on the front panel.

- This applies only to the stand alone types (EXC21 and EXC31). No emergency stop button is provided in the rack mount types (EXC20 and EXC30).

(2) Press the EMG key on the teaching box.

Note: (1)The emergency stop circuit is a B contact (= normally closed). The emergency stop state occurs when you pull off the connector (CN1 on the controller front panel) from the teaching box.

(2)When not using the teaching box, turn power off and insert a dummy connector (included in the accessories) into the teaching box connector CN1, then turn power on again. The emergency stop circuit contacts are shorted in the dummy connector.

(3) Set the EMST input of the control input/output (CN2) to OFF

Note: (1) The emergency stop circuit is a B contact (= normally closed). No adjustments and tests may be performed unless EMST input is turned on when starting up the system.

(2) For the rack mount types, the 24 VDC power for control I/O is supplied externally. If the start up of the 24 VDC power is slower than the startup of the EXC controller, the system determines that the EMST input is off, and the emergency stop state occurs. Be sure to make the startup of the 24 VDC power faster than the startup of the EXC controller.

* You may change the EMST input (CN2) to A contact (= normally open) by shorting pins 30 and 31 at CN2.

(4) Use the EMST command in the remote control mode


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

### 18.3.1.3. Resetting Emergency Stop State

(1) Reset the emergency stop operation.

→ Reset the emergency stop switch on the front panel (the stand alone types only).

→ Turn on CN2: EMST input.

* The EMG key on the teaching box need not be reset. Also no reset operation is required for the EMST command in the remote control operation. These are reset in step (2) described below.

(2)Turn power on again.

* Emergency stop is also reset by performing an alarm reset operation after resetting the emergency stop operation (paragraph (1) above).

- Operation from the teaching box.
  - ○ Press CLR key and then SET key (press the second key within one second).
  - * Do not press these keys simultaneously. Release the CLR key before pressing the SET key, otherwise the emergency stop state will not be reset.
  - * The external operation mode is invalid.

- Operation from the control input/output
  - * In the external operation mode, the emergency stop state is reset by turning on the ACLR input of the control input/output (CN2).

- Resetting emergency stop state in the remote mode.
  - * The emergency stop state can be reset by the ACLR △ ALL command.

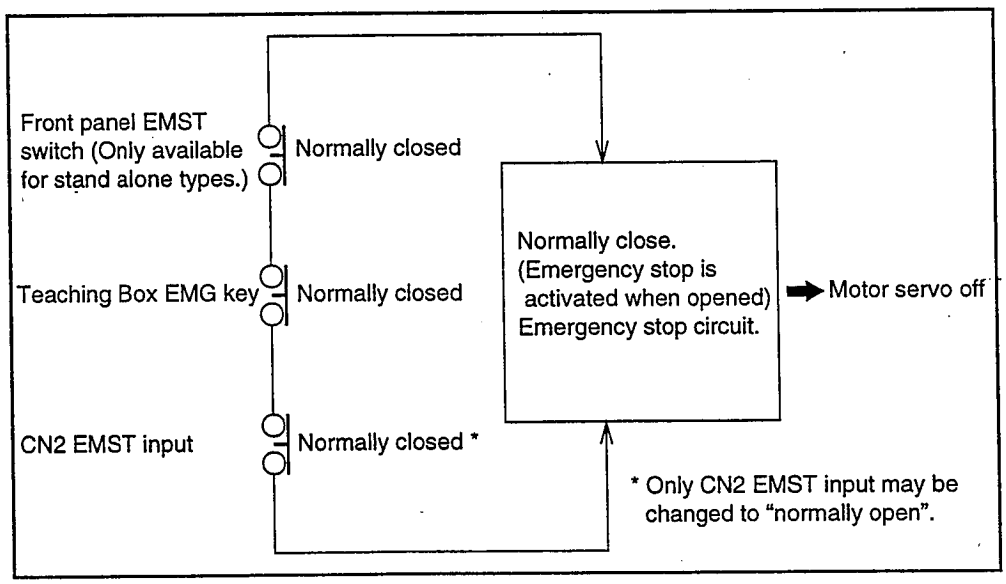
Note: (1) The system will not restart automatically when you reset the emergency stop state. Follow the ordinary startup procedure from the beginning.

(2) The system starts operation from the first part of the program: you may not resume the program halfway.

(3) The general outputs maintain the state before the emergency stop if the emergency stop is reset without turning power on.

### 18.3.1.4. Emergency Stop Circuitry

*Figure 18-1*






Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

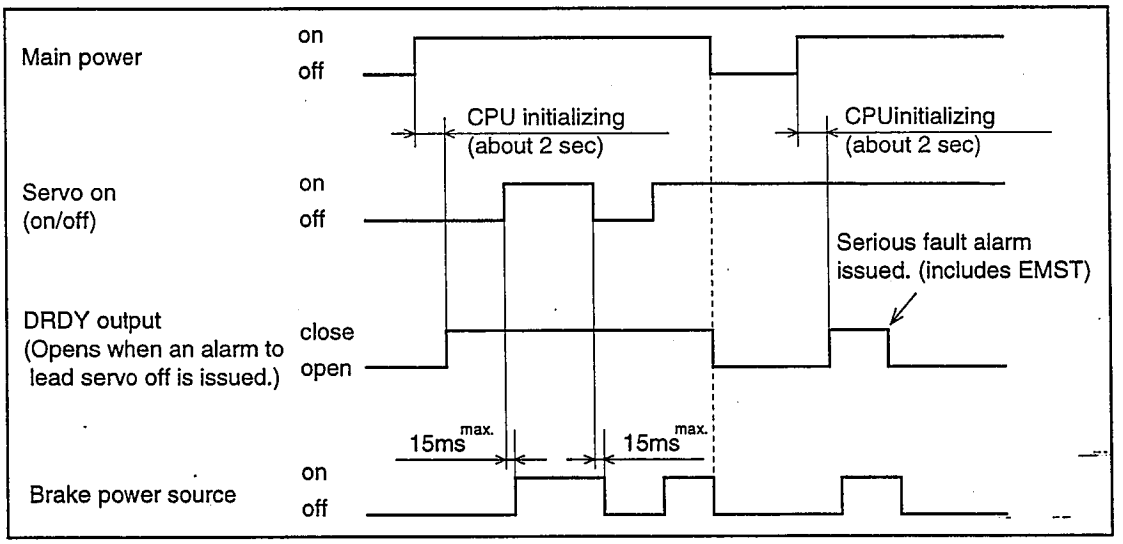
## 18.3.2. Brake Control

- This is the retain brake control function to prevent idle run of the vertical axis motor at servo off.
- Negative actuation brakes are used (braking is effective when power is turned off).
- Refer the hardware interface specifications to the following:
  "Appendix 2 CN6: Specifications for Motor Brake Connector"
- Brake power is turned off in the following cases:
  ① Power to the EXC controller is turned off
  ② In a servo off state
  - External operation mode : Control input/output (CN2) SVON input off
  - Teaching box operation mode : The OFF key on the teaching box is entered.
  - In programmed operation : Servo off is executed by the SRV command of program commands.
  - Remote control mode : SVOF command is executed.

  ③ An alarm leading to servo off has occurred (including emergency stop).
  ④ During the CPU initialize time immediately after turning on power to the controller (approx. 2 seconds).
- The brake output may be turned on and off manually on the teaching box to facilitate tests and adjustments. Refer to " 21.4.2. Monitoring Control I/O and Releasing Brake" for details.

*Caution : The rack mount types (EXC20 and EXC30) do not incorporate a brake power source. The 24 VDC power source (customer to supply) for input/output, which is input from CN2, is also used for the brake.*
*The brake may be damaged if an axis with brake is driven without supplying a brake power source. Be sure to supply 24 VDC.*

*Figure 18-2*





Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 18.3.3. Over Travel Detection

- An alarm is output when the slider travels beyond the specified travel range.
- The motors will stop in the servo on state if OT+ input is turned off when the motor is rotating, or the slider travels beyond the plus-side software limit. At this time, the commands which make the slider to move to only minus-direction are accepted.
- The motors will stop in the servo on state if OT- input is turned off when the motor is rotating, or the slider travels beyond the minus-side software limit. At this time, the commands which make the slider to move to only plus-direction are accepted.

OT+ / OT- input : The overtravel sensors installed on the motor and counter-motor sides of the robot module main unit are connected via CN5.
Refer to "Appendix 1 CN5: Specifications for Encoder and Overtravel Sensor Connector."

* When the pulse train output axis has been set, the overtravel sensors of the pulse train input unit are connected to CN3.
Refer to "16.2. Specifications of Signals Related to Pulse Train Output."

### ● Alarm indication

- When OT+ or OT- input is in the off state, the front panel LED indicates nF03 (n: overtraveled axis number). When the software setting limits are exceeded, nF02 (n: overtraveled axis number) is indicated.

* Refer to "20. Alarms" for details.

### ● Software limit

- Overtravel limit can be set in the software using the absolute coordinates defined by a Home Return operation.
- Refer to "11.5.1. Position and Coordinate Parameter" for the setting of the software limits
  * Software limits are also available for pulse train output axes. See "16.3.3.4. Position and Coordinate Parameter" for the pulse train output axes.

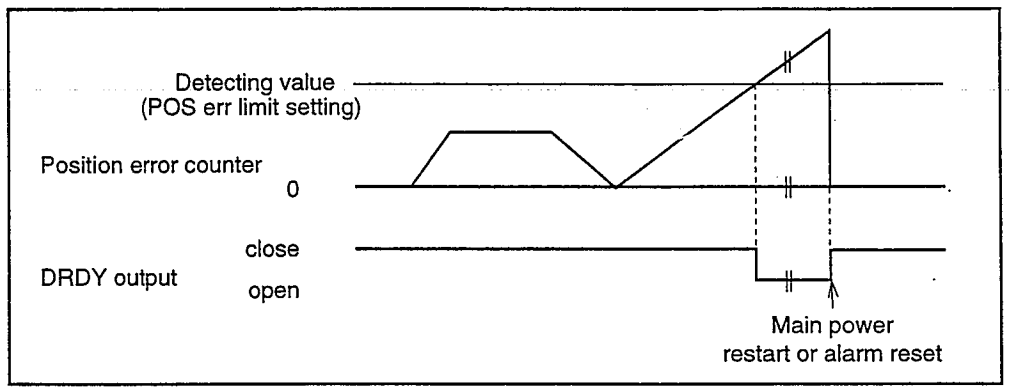

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 18.3.4. Excessive Position Error Detection

- If for any reason the module main unit can not move, the move command is compared with the result of actual move and an alarm is given when the difference (data on the position error counter) is greater than the setting value (excessive position error detect level).

- When the position error counter value exceeds the position error detect level, the DRDY output is open and the motor enters into the servo off state. At this time, nF01 (n: alarm axis number) is shown on the front panel LED.
  * Refer to "20. Alarms."
  * Refer to "11.5.1. Position and Coordinate Parameter" for setting of the excessive position error.

*Figure 18-3: Detecting timing of excessive position.*




## 18.3.5. Software Thermal Protection

- To prevent burning of the motor, the average of the current commands to the motor is monitored and an alarm is given when the average exceeds the rating.

*Caution : This protection will not work if the axes of the module main unit are connected improperly.*

Example: If a module main unit with a 100 W motor is connected to a 300 W output axis, the EXC controller notes the 300 W rating and a current three times the rating will flow through the module main unit (100 W motor), resulting in a motor burn.

Connect the module main unit axes correctly.

→ Prevent incorrect wiring by referring to "9.7. Connecting Controller Cables." Check the axis designation seals on the connector to prevent misconnection.

- The software thermal protection is set to the optimum level at the factory. See "11.4.1. Software Thermal."

## 18.3.6. Protection against CPU Runaway

- The EXC controller alarms are managed by software.

- The software management with the following features prevents loss of safety and protections due to CPU runaway and failure.
  ① Monitors CPU runaway and failure with watchdog timers, etc.
  ② Stops the motors by servo off and issues an alarm if the CPU does not respond for more than 10 ms.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# 19. Maintenance and Checking

## 19.1. Maintenance

- Spare parts
  - ○ Spare parts should be available to repair the system as quickly as possible in case of a failure.
- Recording parameters
  - ○ Record the current parameter values in case of a failure.
  - ○ Refer to Table 11-3 Initial setting list in "11.2. Initial Setting List."

* For pulse train output setting, see Table 16-33 in "16.3.1. Initial Setting of Pulse Train Output."

## 19.2. Periodical Check

- Periodically check and replace parts to use the robot module for a long time.

### 19.2.1. Robot Module Main Units and Cables

#### 19.2.1.1. Weekly Check

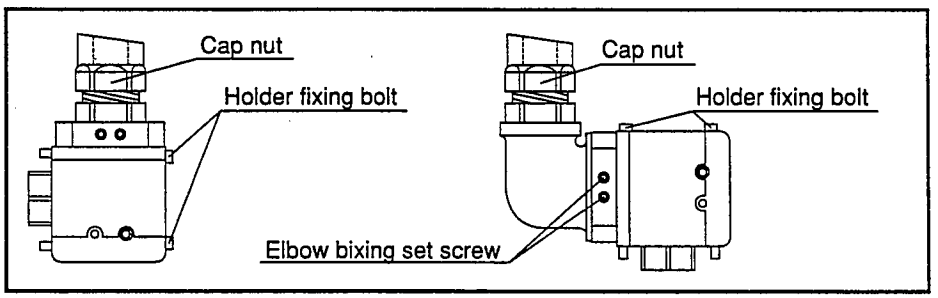
*Warning : The checkings should be performed at least once a week according to Table 19-1 to prevent accidents due to loose bolts and screws.*

*Table 19-1: Weekly Check*

| Where to check | Description |
|---|---|
| Main unit fixing bolt | • Tighten if loose. |
| Work fixing bolt | • Refer the tightening torque to "7.1. Installing of Module Main Unit." |
| Main unit seat belt | • Wipe off dust. |
| Robot cables (Figure 19-1) | • Tighten loose cap nuts. Tightening torque: 7.5 to 9.0 N·m {77 to 92 kgf·cm}<br>• Tighten loose holder fixing bolt (M3). Tightening torque: 1.47 N·m {15 kgf·cm}<br>• Tighten loose elbow fixing set screws(M5 hexagon socket set screws). Tightening torque: 1.47 N·m {15 kgf·cm} |
| Controller cables | • Replace damaged or heavily scarred cables. |

Note: No motor brush replacement is required because AC servo motors are used.

*Figure 19-1*





Artisan Technology Group - Quality Instrumentation Guaranteed | (888) 88-SOURCE | www.artisantg.com

### 19.2.1.2. Replenishing Grease

Danger : *Supply grease only after shutting power off to the controller. Do not enter the robot working area when the system is energized.*

○ For units with a brake, turn power off after moving the slider to the specified position by jogging referring to "14.3.2. Jog Operation by Teaching Box."

Caution : *Ball screw and linear guides of the module main unit will be damaged if operated without grease. Supply grease in the steps below.*

**Replenish interval**

- One year (for a single-shift operation), or every 3000 km.
- Half the above intervals when the system is used in the range close to the upper limit of the transportable moment.

**Recommended grease**

- Alvania No. 2

**How to refill**

◆H module

(1)Set the slider to the stroke end on the counter-motor side.

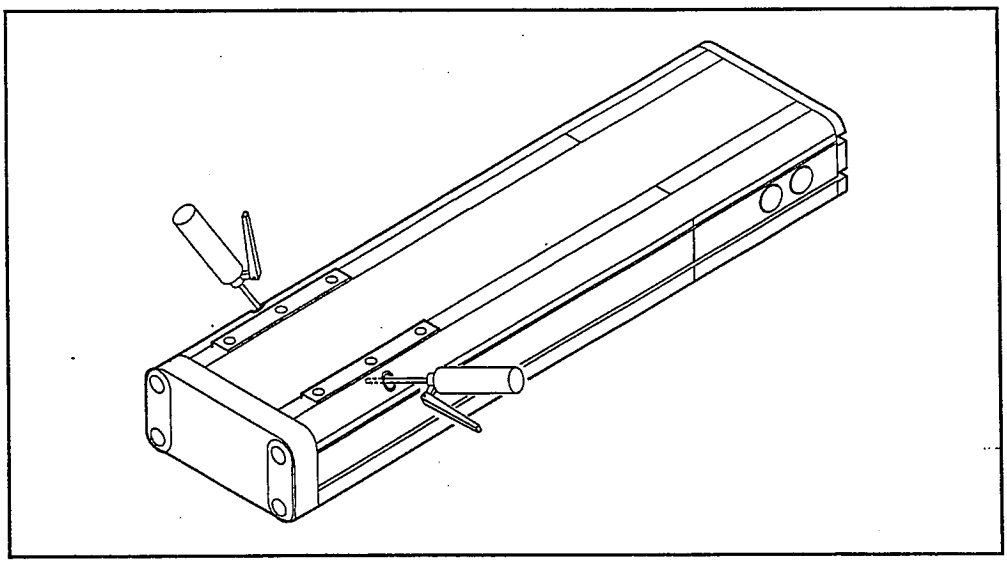
(2)Remove the black cap from the side cover with a slotted screwdriver, etc.

(3)Identify the grease nipple under the side cover. Fill approximately 20 cc grease with a grease gun (Figure 19-2).

(4)Replace the cap.

(5)Fill the opposite side in the same manner.

*Figure 19-2: H module*





Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

◆M module

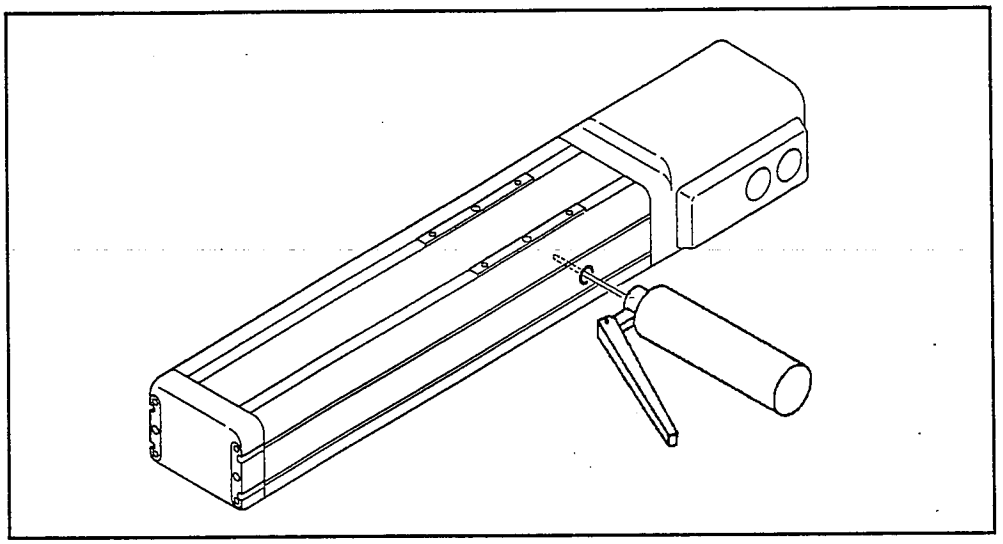
(1)Set the slider 40 mm from the stroke end on the motor side.

(2)Remove the black cap from the side of the main unit with a slotted screwdriver, etc.

(3)Identify the grease nipple inside the main unit. Fill approximately 10 cc grease with a grease gun (Figure 19-3).

(4)Replace the cap (should be flush with the frame).

*Figure 19-3: M module*



◆S module and S module verticalaxis

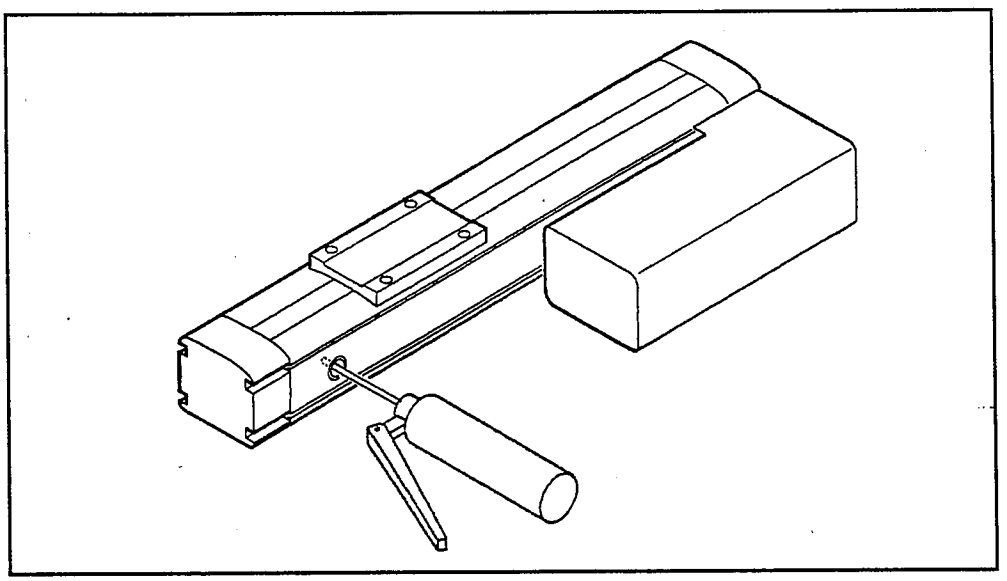
(1)Set the slider 35 mm from the stroke end on the counter-motor side.

(2)Remove the black cap from the side of the frame with a slotted screwdriver, etc.

(3)Identify the grease nipple inside the frame. Fill approximately 2 cc grease with a grease gun (Figure 19-4).

(4)Replace the cap (to be flush with the frame).

*Figure 19-4: S module*





Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

### 19.2.1.3. Changing S Module Timing Belt

- A timing belt is used in the S module to transmit motor power. Its life is generally shown below.
- A special tool is required to change the timing belt. Order one from the NSK representative where you purchased the unit when replacing the belt.

*Table 19-2*

| Reference No. | Ball screw lead | Travel distance | Period in case of single shift (guide lime) |
|---|---|---|---|
| XY-HRS××××S1×× | 10 mm | 3000 km | 1 year |
| XY-HRS××××S2×× | 20 mm | 6000 km | 2 year |

## 19.2.2. EXC Controller

### 19.2.2.1. Periodical Check

- The items in Table 19-3 should be checked at least once a month.

*Table 19-3*

| Item | Check contents |
|---|---|
| Tightening screws | • Check AC power input terminal block and connector screws for looseness. |
| Cleaning | • Remove dust and foreign matter from the inside area of the unit.<br>• Clean air intake filters of the fan (stand-alone type only). |

*Danger : Do not check the unit while it is energized. A high tension exists. Start checking at least 5 minutes after turning power off.*

*Danger : Electric shocks and short-circuits may occur if cables are disconnected through loose screws on the terminal block (AC power input terminal).*

*Check screws for looseness. Tighten all loose screws.*


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

### 19.2.2.2. Periodical Replacement

- The following parts of the EXC controller are subject to aging or deterioration due to repeated use, possibly affecting system performance and causing a system failure.

- Replace them on reaching the suggested replacement life.

*Table 19-4*

| Item | Memory back- up | Replacement guide line |
|---|---|---|
| Lithium battery | Contacts controlling the brake | • Total deactivated time of the controller: 1800 hours<br>→ about 2 years without turning power on |
| Relay | Electrolytic condenser<br>Smoothing voltage of main | • Total number of times of brake on/off: couple of hundred thousands<br>→ about 9 years if 30 times/day of on/off are performed. |
| Function | power | • Guide line: 5 to 10 years ( Varies with surrounding condition, especially it is affected by ambient temperature.) |

*Danger : Do not charge the lithium batteries. If charged, they may burst or burn.*

**Replacing lithium battery**

- Replace the lithium battery once every 2 years according to the following procedure.

Batteries to be used : Toshiba ER6VC39 or equivalent
Mitsubishi ER6-RC-19 or equivalent
NSK reference number: M-E5118-0003

**● Replacing batteries on the rack mount types (EXC20 and EXC30)**

①Allow the unit to sit for at least 60 minutes after turning power on. The supercapacitor in the controller is charged to be used as a backup power when replacing the battery.

*Danger : Do not enter the robot module working area when the power is on. It is dangerous because the robot could start while you are in the robot module working area.*

②Turn power off (at the power switch provided by the customer).

③After 5 minutes on turning power off, remove the right-hand side panel as viewed from the front.

- Remove 4 screws on the side and 3 at the back.
- Remove the side panel.

*Danger : Electric charges remain in the controller when power is turned off, and electric shock hazard exists. Wait for 5 minutes before removing the side panel.*

④The battery is held in place in the main body case with masking tape. Remove the connector and then the masking tape.

⑤Insert a new battery into the connector, and hold it in place with maskoing tape.

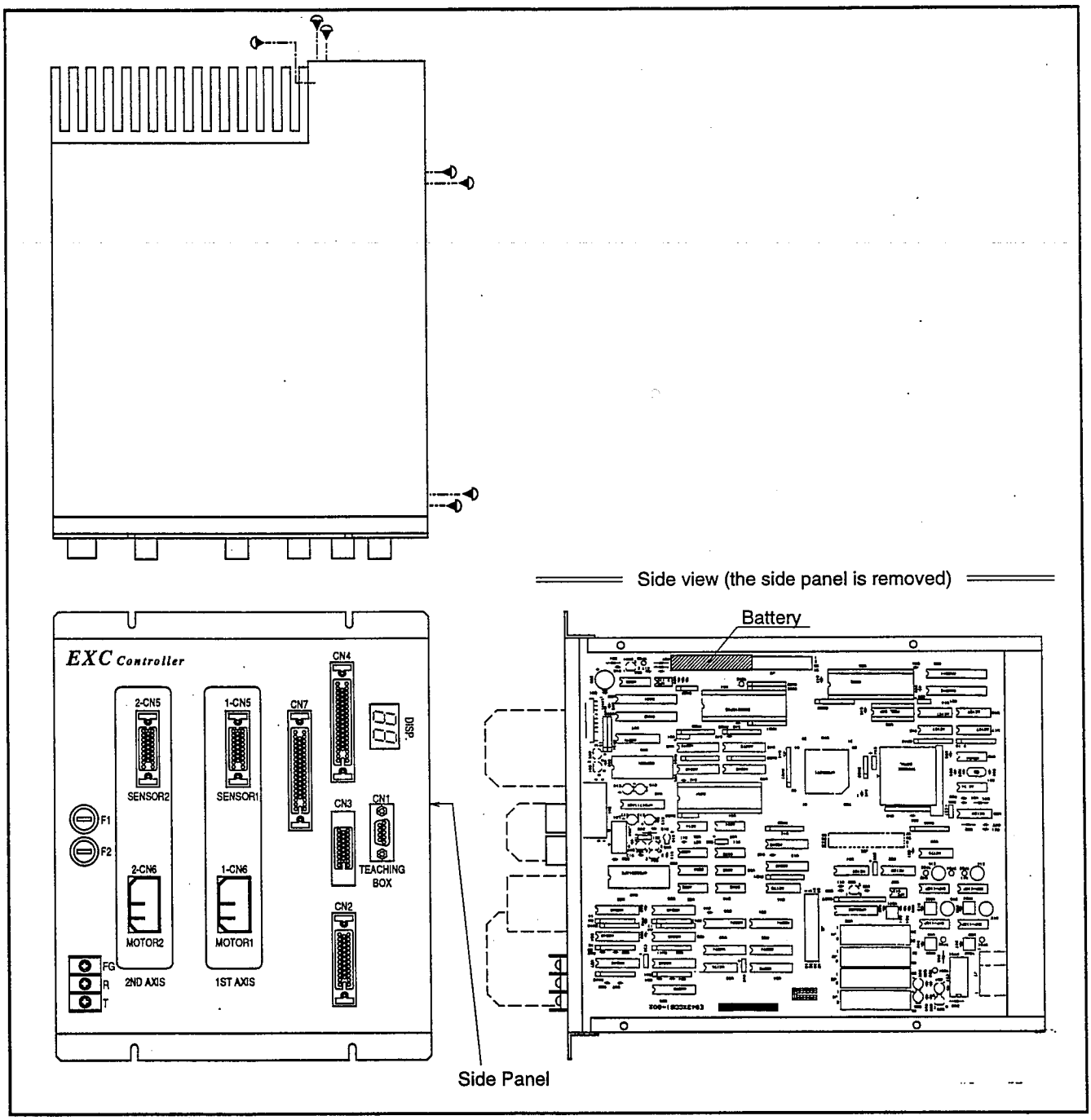
*Caution : The connector has an orientation and will not accept a battery inserted in the wrong direction. Never force the battery into the connector. The battery slides into the connector smoothly when inserted in the correct direction.*


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Caution : *Complete the battery replacement within 20 minutes after turning power off. If the replacement takes more then 20 minutes, the supercapacitor may be fully discharged and the memory may not be held.*

⑥Replace the side panel and tighten the screws.

*Figure 19-5*






Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## ● Replacing batteries on the stand-alone types (EXC21 and EXC31)

① Allow the unit to sit for at least 60 minutes after the power is turned on. The supercapacitor in the controller is charged to be used as a backup power when replacing the battery.

Danger : *Do not enter the robot module working area when the power is turned on. It is dangerous because the robot could start while you are in the robot module working area.*

② Turn power off (with the power switch on the front panel).

③ After 5 minutes on turning power off, remove the right-hand side panel as viewed from the front.

- Remove 4 screws on the top.
- Remove the top panel.

Danger : *Electric charges remain in the controller when power is turned off, and electric shock hazard exists. Wait for 5 minutes before removing the side panel.*

④The battery is held in place in the main body case with masking tape. Remove the connector and then the masking tape.

⑤Insert a new battery into the connector, and hold it in place with maskong tape.

Caution : *The connector has an orientation and will not accept a battery inserted in the wrong direction. Never force the battery into the connector. The battery slides into the connector smoothly when inserted in the correct direction.*

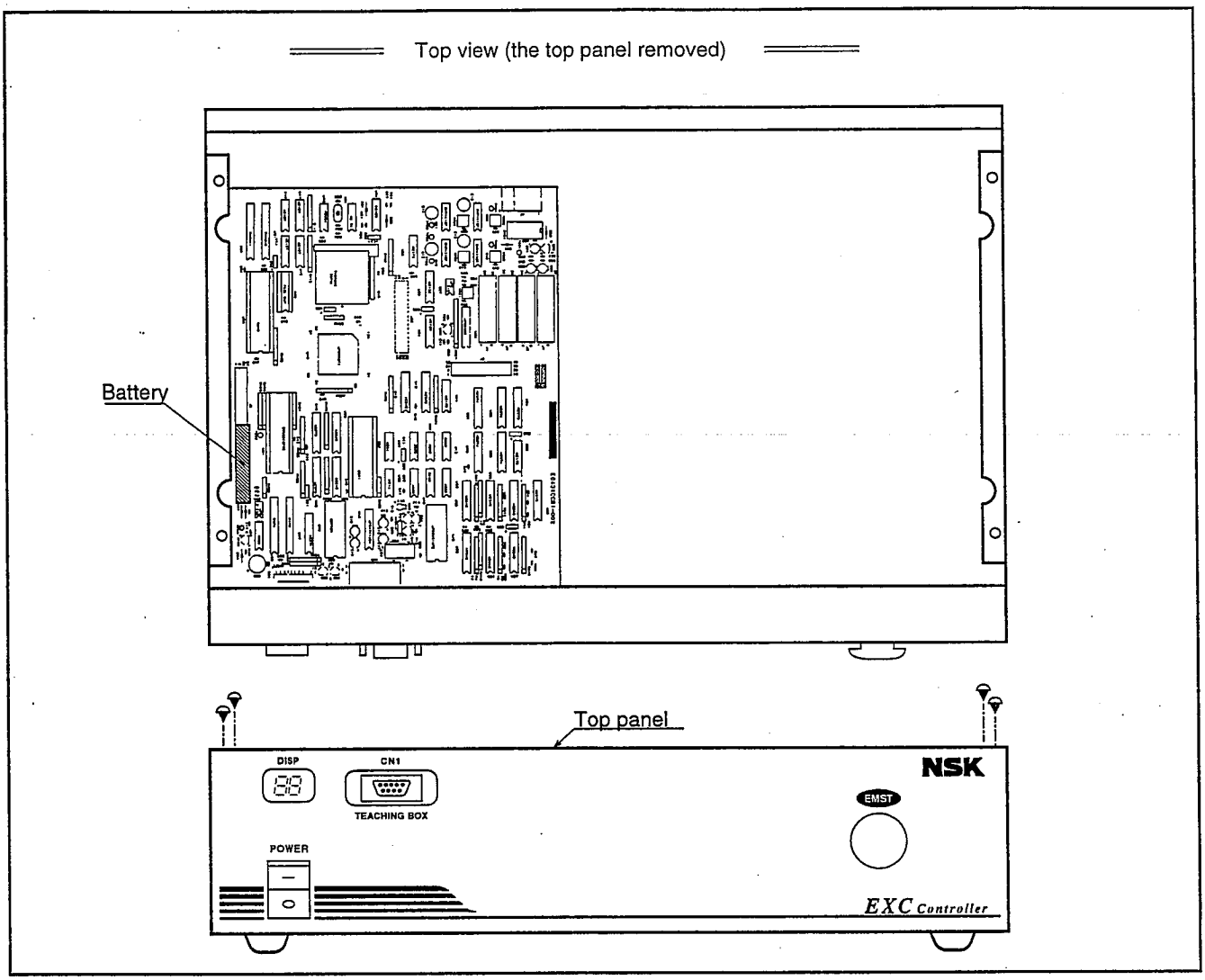
Caution : *Complete the battery replacement within 20 minutes after turning power off. If the replacement takes more than 20 minutes, the supercapacitor may be fully discharged and the memory may not be held.*

⑥Replace the side panel and tighten the screws.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

*Figure 19-6*




## Replacing relay

- Please consult to NSK.
  Omron: G6B-1174P-FD-US (DC5V)

## Electrolytic condenser

- Replacing the EXC controller is necessary. Please consult to your local NSK representative.


Artisan Technology Group - Quality Instrumentation Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 19.3. Warranty Period and Range

### 19.3.1. Warranty Period

- The warranty period is one year from the date of delivery of the product or 2400 working hours whichever comes first.

### 19.3.2. Range of Warranty

①The items to be warranted are the supplied products.

②The supplier will repair the supplied products free of charge within the warranty period.

③The supplied products will be repaired with cost and fees paid by the customer after the warranty period.

④The above applies only to the products delivered and used in Japan.

### 19.3.3. Immunities

- The product is not warranted even within the warranty period in one of the following cases:

①Failure of the unit due to installation and operation not in accordance with the instruction manual specified by the supplier.

②Failure of the unit due to improper handling and use, modification, and careless handling by the user.

③Failure of the unit due to causes other than those attributable to the supplier.

④Failure of the unit due to modification or repair done by a person(s) or party(ies) other than the supplier.

⑤Other types of failures due to natural disasters and accidents (causes not attributable to the responsibility of the supplier).

⑥Designated consumable (fuses for the EXC controller, timing belt for the S modules).

- Not cover damages induced by a failure of the supplied unit.

### 19.3.4. Service Fee

- The price of the supplied product does not include service charges such as dispatch of engineer(s).
- Startup, maintenance and adjusting of the unit under the supervision of our engineer(s) is a paid service even if it is to be provided during the warranty period.
- Service fees shall be billed to the customer according to the rules on paid services.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

(Blank page)



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# 20. Alarms

- This section describes the alarms of EXC controller.

## 20.1. Alarm Indication

- Errors and alarms in the EXC controller are output through the control I/O connector CN2 and indicated by the 7-segment LED on the front panel of the EXC controller and display on the teaching box.
- When the remote control operation mode through RS-232C interface is being executed,[ !CR ] code is output.

### 20.1.1. CN2 Output

- The DRDY and WRN signals are output through CN2. These functions are as follow.

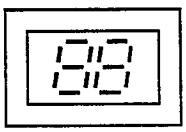
  DRDY: (Ready) ----- Opens when a serious error occurs.

  WRN :(Warning) --- Closes when an unserious error occurs.

- CN2 alarm signals are output always regardless the control mode such as remote control, operation by teaching box and remote control.

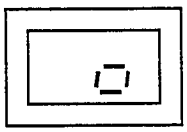
### 20.1.2. Seven Segment LED

*Figure 20-1: 7-segment LED*



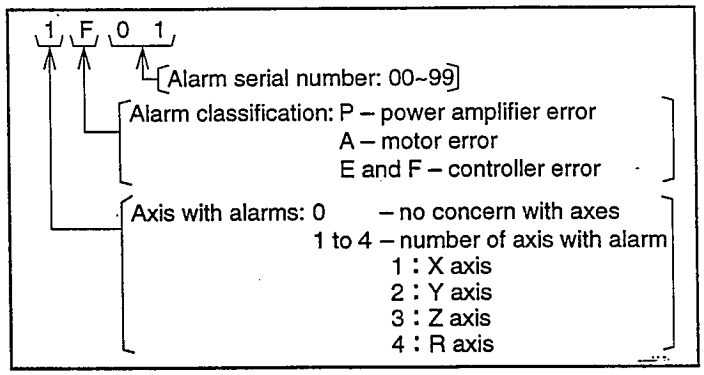
**● Normal display**

*Figure 20-2: Normal display of 7-segment LED*



**● Alarm display pattern**

*Figure 20-3: Alarm display*



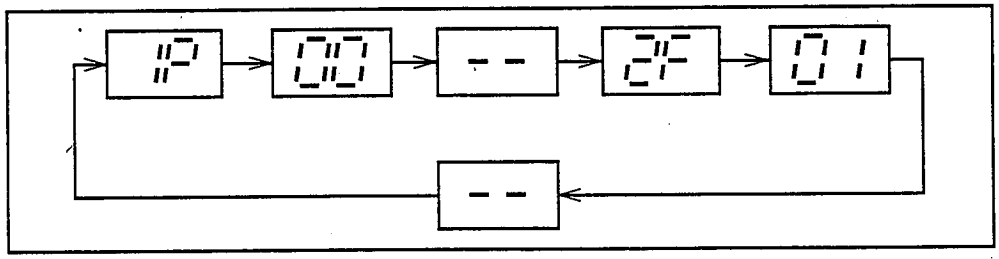



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- The 7-segment LED has 2 digits which display the above pattern by time sharing. If two or more alarms occur simultaneously, their codes are also displayed by time sharing.

**Example: X axis overheat + Y axis excessive position error**

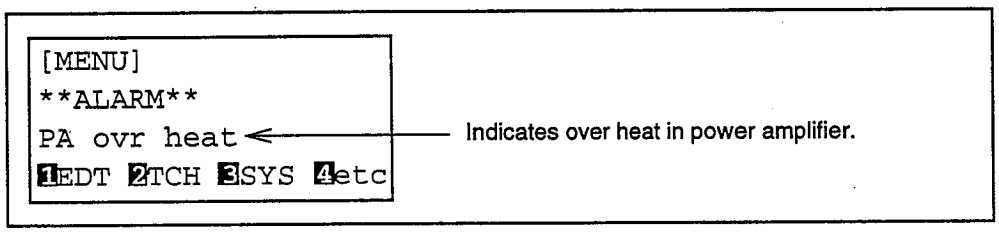
*Figure 20-4: Display pattern in case of two or more alarms*




## 20.1.3. Display on Teaching Box

- When the teaching mode is selected, the alarm indication is displayed on the third line of the display screen.
- If two or more alarms occur simultaneously, they are displayed one by one at an interval of 1 second or so.

*Figure 20-5 : Example*




## 20.1.4. Display in Remote Control Mode

- Refer to "15.5. Abnormal Response."


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 20.2. Motor Condition in Case of Alarms

- The motor enters the servo lock state in case of minor failures (WRN output closed).

* The unit operates normally in case of a low battery alarm.

- The motor enters the servo off state in case of critical failures (DRDY output open).

(Caution) : *Regenerative and dynamic brakes are not incorporated. When a critical failure occurs when an axis without a brake is moving, the axis may not stop immediately but run by inertia.*

○ In the above case, the axis normally stops at the stroke end. If, however, the unit is operating with a load exceeding the maximum transportable load specified for the module main unit, the mechanical stopper installed on the stroke end may be broken. Observe the maximum transportable load.

## 20.3. Alarm List

### 20.3.1. Normal State

- The normal state is shown below.

*Table 20-1*

| 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|
| o | close | open | – |

- Even in the normal operation, the 7-segment LED messages may be missing, or the DRDY and WRN outputs may indicate an error. See the table below.

*Table 20-2*

| Item | Motor | 7-segment LED | DRDY output | WRN output | Cause | Action |
|---|---|---|---|---|---|---|
| Power off | Servo off | | Open | Open | Power is not turned on | Turn it on |
| CPU initializing | Servo off | | Open | Open | CPU is being initialized | Wait for a while (2 seconds or so) |


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 20.3.2. Alarm List

- Table 20-3 shows all alarms issued in abnormal stage.

*Table 20-3: Alarm list*

| Item | Motor | 7-segment LED | DRDY output | WRN output | Teaching box display | Symptoms and causes | Refer to: |
|---|---|---|---|---|---|---|---|
| Overheat | Servo off | *n* P00 | open | open | PA ovr heat | • Power amplifier output circuit or internal dump resistor overheated. | 20.4.1. 21.1.12. Appendix 4 |
| Abnormal main power voltage | Servo off | *n* P01 | open | open | PA mot volt | • The main power voltage after rectification too high or low. | 20.4.2. |
| Overcurrent | Servo off | *n* P02 | open | open | PA ovr corr | • An excess motor current applied. | 20.4.3. |
| Low control power voltage | Servo off | *n* P03 | open | open | PA con volt | • Control power voltage after rectification too low. | 20.4.4. |
| Power amplifier abnormal | Servo off | *n* P05 | open | open | PA abnormal | • Power amplifier failed to start up correctly.<br>* This alarm will not occur in the normal state. | 20.4.5. |
| Encoder disconnection | Servo off | *n* A00 | open | open | Encorder | • Encoder signals are not correctly accepted. | 20.4.6. 21.2.4. |
| Overload | Servo off | 0A03 | open | open | Thermal | • Motor duty exceeds the rating. | 20.4.7. |
| Memory error 1 | Servo off | 0E00 | open | open | Memory 1 | • Initial setting parameters were changed due to noise, etc. | 20.4.8. 21.1.11. |
| Memory error 2 | Servo off | 0E01 | open | open | Memory 2 | • The program was changed due to noise, etc. | 20.4.9. 21.1.11. |
| Low battery voltage | Normal operation | 0E05 | close | close | Battery | • Battery voltage fell to 2.2 V or below. | 20.4.10. |
| CPU error | Servo off | Indefinite/ 0E06 | open | open | Retain previous display/CPU | • CPU runaway due to noise, etc. | 20.4.11. |
| System mismatch | Servo off | 0E07 | open | open | System type | • 3-axis system parameters are used for a 2-axis controller.<br>* This alarm will not occur in the normal state. | 20.4.12. |
| Excessive position error | Servo off | *n* F01 | open | open | Pos. err | • The position error counter value exceeded the limit level. | 20.4.13. |
| Software travel limit | Servo lock in one direction | *n* F02 | close | close | OT(soft)□* | • The slider moved beyond the software travel limit. | 20.4.14. 18.3.3. |
| Hardware travel limit | Servo lock in one direction | *n* F03 | close | close | OT□* | • Travel limit is in the input off state. | 20.4.15. 18.3.3. |
| Emergency stop | Servo off | 0F04 | open | open | EMST | • Emergency stop state occurred. | 20.4.16. 21.1.8. 18.3.1. |

* □ represents an axis to which an alarm is issued. [X, Y, Z and R]


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

*(Alarm list continued)*

| Item | Motor | 7-segment LED | DRDY output | WRN output | Teaching box display | Symptoms and cause | Refer to: |
|---|---|---|---|---|---|---|---|
| Program error | Servo lock | 0F05 | close | close | Prog not found | ● A grammatical error may exists in the program or tried to execute a program which is not operable. | 20.4.17. |
| | | | | | Step not found | | |
| | | | | | Axis mismatch | | |
| | | | | | Data range over | | |
| | | | | | Undefind TAG | | |
| | | | | | Duplicate TAG | | |
| | | | | | Too many CALL | | |
| | | | | | Without CALL | | |
| | | | | | Too many REP | | |
| | | | | | Without REP | | |
| | | | | | Can't make cir | | |
| | | | | | Servo off | | |
| | | | | | Axis offline | | |
| | | | | | Pallet empty | | |
| | | | | | Too many CALP | | |
| | | | | | Without CALP | | |
| | | | | | Data overflow | | |
| | | | | | Data mismatch | | |
| | | | | | Origin not executed | | |
| | | | | | Without interrupt | | |
| | | | | | Int.prog not found | | |
| | | | | | Without interrupt | | |
| | | | | | Int. prog not found | | |
| | | | | | Can't make path | | |
| | | | | | Can't make path (a) | | |
| | | | | | Can't make path (v) | | |
| | | | | | Can't make path (d) | | |
| | | | | | With out CPS | | |
| | | | | | Undefind command | | |
| | | | | | Can't restart prog | | |
| | | | | | Rsta prog not found | | |
| Home Return error in pulse train output | Servo lock | *n* F06 | close | close | Origin err ☐ * | ● Home input is not on in one minute after HOS output is closed. | 20.4.18. |
| Alarms of pulse train output | Servo free | *n* F07 | open | open | Pulse ALM port ☐ * | ● ALM input of CN7 connector is off. | 20.4.19. |

* ☐ represents an axis to which an alarms issued.[ X,Y,Z or R ]



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 20.4. Description of Alarms

*Danger : Check the following before attempting to identify the cause of an alarm or take necessary action according to the description in this paragraph. If these items are not observed, the identification work itself can be dangerous and further critical accident may occur due to secondary accidents such as motor burns and runaway.*

(1) Matching of module main unit and power amplifier.

- Check that the motor output specifications for the module main unit conform with the driver output specifications for the controller, and the main power voltage of the module main unit with that of the controller.

  Example of error ①: X axis (300 W axis) and Z axis (100 W axis) were erroneously connected to the controller.

  Example of error ②: A 200 V controller was connected to a 100V module.

(2) Using NSK's standard cables is recommended.

- If you have manufactured the cables by yourself or modified the originals, check that there is no mis-wiring.

  Example of error ①: System runaway may occur if U, V, and W wires of the motor power line are wrongly connected.

  Example of error ②: System runaway may occur if encoder signal lines are wrongly connected.

(3) Check that the supply voltage is correct.

- ○ EXC □ □ A □ □ □ A □ □ : 180 to 242 VAC, single – phase
- ○ EXC □ □ A □ □ □ C □ □ : 90 to 121 VAC, single – phase

The driver may be burned if the above voltage range is exceeded.

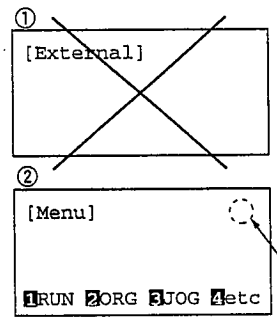
(4) Make sure that you did not erroneously connect the FG terminals and AC power lines. If the AC power is connected to the FG terminal, or to the ground, the controller may function improperly and burn out.

*Danger : Before attempting to identify the cause of the alarm and take necessary action according to this paragraph, check that the movable parts of the module main unit have completely stopped, set the system to the servo off state, and turn power off. This is necessary to prevent the operator being crushed, caught or pulled into the unit. If you must work with power on for an unavoidable reason, take full safety measures referring to the following.*

① Do not enter the area bound by the safety fences.

② Observe the following when you must work inside the safety fences.

○ Set the controller to the teaching mode operation and at the same time set it to the servo off state. This is necessary to prohibit external servo on operation and driving of the unit.




: Check that the system mode selected is not the external operation mode.
Do not enter the area bound by the safety fences if the monitor shows display ①.

: Check that the servo on mark (*) on the upper right-hand corner of the display is turned off.

Servo off display



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

○ When you must perform servo on operation or drive the system while checking for an unavoidable reason, make sure that no person and equipment that might be damaged are present in the robot working area. Also provide necessary means to prevent entry of persons into the area while you are working.

○ Keep the teaching box near the checker ready for immediate use in case of need.

○ Before starting the work, test that the emergency stop state occurs as it should when you press the emergency stop key on the teaching box (that is, you should start working after making sure that the emergency stop function will work properly).

○ Do not touch the power supply where the electric shock hazard exists. Do not turn power on with covers open.

## 20.4.1. Overheat

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo off | *n* P00 | open | open | PA ovr heat |

*Warning : Be careful of a burn when the overheat alarm is issued because the radiator and the regenerative dump resistor are hot.*

- There are two types of overheat (not discriminated by alarms). An alarm is issued when either or both thermal sensors installed on the following two points are turned off:
  ① Radiator on the power amplifier output stage.
  ② Internal dump resistor for processing regeneration.

- The EXC controller stops immediately and the motor enters the servo off state when this alarm occurs. Turn power off and identify the cause and take necessary action after the unit is sufficiently cooled.

*Table 20-4*

| Classification | Cause | Action |
|---|---|---|
| Power amplifier output stage | ● High ambient temperature | ● Decrease ambient temperature.<br>● Forcibly cool the radiator with a fan, etc. |
| | ● Excessive duty or load.<br>* An overload alarm is issued before this alarm because protection by software thermal is effective normally. | ● Decrease duty or load.<br>● Decrease acceleration/deceleration. |
| | ● Defective thermal sensor or broken internal wiring. | ● Replace controller.<br>→ Contact your local NSK representative. |
| Regenerative dump resistor | ● High ambient temperature | ● Decrease ambient temperature. |
| | ● Regenerative energy is too large to be processed by internal dump resistor, resulting in overheat.<br>→ Long stroke of the vertical axis, large load.<br>→ Large acceleration/deceleration, high acceleration/deceleration frequency. | ● See Appendix 4 Regeneration Processing<br>* The internal dump resistor may not be directly cooled externally. |
| | ● Defective thermal sensor or broken internal wiring. | ● Replace controller.<br>→ Contact your local NSK representative. |


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 20.4.2. Abnormal Main Power Voltage

*Caution : Power should immediately be turned off in the case of abnormal main power voltage. The internal circuits may be burned unless the power is turned off immediately if overvoltage had occurred due to input of a voltage exceeding 242 VAC.*

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo off | *n* P01 | open | open | PA mot volt |

- The single-system power input terminal for the EXC controller is divided into main and control power system in the controller. This feature monitors the voltage at the main power system, and issues an alarm.
- There are two types of abnormal main power voltage (not discriminated by the alarm display).
  ① Overvoltage • • • Main power voltage after rectification exceeds 400V.
  ② Low voltage • • • Main power voltage after rectification drops below 60V.
- The EXC controller stops immediately and the motor enters the servo off state when this alarm occurs. Immediately turn power off and then identify the cause and take necessary action.

*Table 20-5*

| Classification | Cause | Action |
|---|---|---|
| Overvoltage | ● Main source voltage was erroneously input.<br>Example: 400 VAC.<br>● Defective power supply (large voltage fluctuation, etc.) | ● Check and use a correct power supply. |
| | ● Regenerative energy is too large to be processed by internal regenerative processing circuit, resulting in increased source voltage.<br>* Normally, the above overheat alarm (regeneration) occurs first. | ● See "Appendix 4 Regeneration Processing." |
| | ● Regenerative energy processing circuit failed and source voltage increased.<br>● Overvoltage detecting circuit failed. | ● Replace controller.<br>→ Contact your local NSK representative. |
| Low voltage | ● Broken, non- or mis-wiring of power supply cables | ● Check and correct wiring. |
| | ● Defective power supply (large voltage fluctuation, etc.) | ● Check and use a correct power supply. |
| | ● Low voltage detecting circuit failed, or internal power source wiring is broken or defective contact. | ● Replace controller.<br>→ Contact your local NSK representative. |


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 20.4.3. Overcurrent

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo off | *n* P02 | open | open | PA ovr corr |

- The overcurrent feature monitors the current flowing through the motor and issues an alarm when the current exceeds 3 times the motor rated current.
- The EXC controller stops immediately and the motor enters the servo off state when this alarm occurs. Turn power off and then identify the cause and take necessary action.

*Table 20-6*

| Cause | Action |
|---|---|
| • A large current flowed because motor windings or motor cables shorted (a short across lines). | • Check motor and cables and replace when necessary. |
| • A large current flowed because motor windings or motor cables are grounded (a short with the ground). | • Check motor and cables and replace when necessary. |
| • The rise in the current command from the control unit is too steep and an overcurrent flowed through the motor momentarily.<br>→ Excessive acceleration/deceleration or load<br>→ An acute angle in the path of continue path program. | • Decrease acceleration/deceleration and load.<br>• Provide a radius (arc) to the acute angle path in the continue path program (see "13.2.4.5. Continue Path" Restrictions for Continue Path Program). |
| • Overcurrent detecting circuit failed or internal wiring broken. | • Replace controller.<br>→ Contact your local NSK representative. |

## 20.4.4. Low Control Power Voltage

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo off | *n* P03 | open | open | PA cont volt |

- The single-system power input terminal for the EXC controller is divided into main and control power system in the controller. This feature detects a low control power (70 V or less after rectification), and stops the unit to prevent improper operation of the control board due to instable control power (5 VDC system).
- When the power voltage drops, this alarm is activated earlier than the main power voltage abnormal (low voltage) alarm.
- When this alarm occurs, the EXC controller stops immediately and the motor enters the servo off state. Immediately turn power off and then identify the cause and take necessary action.

*Table 20-7*

| Cause | Action |
|---|---|
| • Defective power supply (large voltage fluctuation, etc.) | • Check and use a correct power supply. |
| • Thin and long power cables.<br>→ Voltage drops at the maximum current flow. | • Use thick and short power cables. |
| • Broken, non- or mis-wiring of power supply cables | • Check and correct wiring. |
| • Low voltage detecting circuit failed, or internal power source wiring is broken or defective contact. | • Replace controller.<br>→ Contact your local NSK representative. |


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 20.4.5. Power Amplifier Abnormal

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo off | *n* P05 | open | open | PA abnormal |

- This alarm will not occur in the normal state. When excessive acceleration/deceleration is commanded for an excessive load (a large starting current rising sharply), the noise in the controller can not escape and may cause this alarm to occur.
  → Establish noise preventive measures referring to "9.2.4 Noise Preventive Measures."
  → Review routing of power and motor cables or take suitable action to prevent the affection of noise.
- If this alarm occurs just after turning power on , replace the controller. Contact NSK for details.
- When this alarm occurs, the EXC controller stops immediately and the motor enters the servo off state.

## 20.4.6. Encoder Disconnection

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo off | *n* A00 | open | open | Encorder |

- This feature monitors the level of the line driver differential signals output from the encoder, and issues an alarm when the output is not a differential output (the feature determines that encoder signals are not correctly received).
- When this alarm occurs, the EXC controller stops immediately and the motor enters the servo off state. Turn power off and then identify the cause and take necessary action.

*Table 20-8*

| Cause | Action |
|---|---|
| • Encoder cables shorted, grounded or broken.<br>• Missing wiring | • Check continuity of controller and robot cables, short-circuit and grounding of signals. Replace any defective parts. |
| • Breakdown of the line driver for outputting encoder signals. | • Replace module main unit.<br>→ Contact your local NSK representative. |
| • Encoder break detecting circuit failed.<br>• Switching power source in the controller failed. | • Replace controller.<br>→ Contact your local NSK representative. |

* If the cables are shorted or grounded, the encoder as well as the encoder signal receiving circuits could be damaged. If the cables are replaced but the system will not work, the encoder body as well as the encoder signal receiving circuits might have been damaged.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 20.4.7. Overload (Software Thermal Protection)

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo off | 0A03 | open | open | Thermal |

- This feature monitors the average of motor current commands, and issues an alarm when the average exceeds the motor rated current.

- When this alarm occurs, the EXC controller stops immediately and the motor enters the servo off state. Turn power off and then identify the cause and take necessary action.

*Table 20-9*

| Cause | Action |
|---|---|
| ● Excessive motor duty, load and acceleration/deceleration. | ● Decrease motor duty, load and acceleration/deceleration. |
| ● Software thermal initial setting error. | ● Correct the software thermal initial setting.<br>→ See "11.4.1. Software Thermal." |
| ● System operated without releasing the brake.<br>→ For the rack mount type EXC controller, 24 VDC power is not supplied, or 24 VDC power mis-wiring.<br>→ Broken brake wires for controller or robot cables.<br>→ For stand alone type EXC controller, defective built-in 24 VDC power source. | ● Check and correct 24 VDC power source and wiring.<br>● Check and replace defective controller and robot cables, and braking wiring.<br>● Replace the built-in 24 VDC power source.<br>→ Contact your local NSK representative. |

## 20.4.8. Memory Error 1

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo off | 0E00 | open | open | Memory 1 |

- The data in the memory are sum-checked on making power and periodically thereafter. An alarm is issued on detecting an error. The Memory Error 1 checks the initial setting parameter memory.

- When this alarm occurs, the EXC controller stops immediately and the motor enters the servo off state. Initialize the memory and then set the initial setting parameters.
  - → When the alarm occurs on making power, you may initialize the memory using the teaching box (see "10.1.2. Checking Points When Turning on Power").
  - → When the alarm occurs after making power, initialize the memory referring to "21.3.1. Memory Initialize."
  - → For alarms occurring in the remote control mode, see "15.5. On Abnormal Response."

*Table 20-10*

| Cause | Action |
|---|---|
| ● A large rush noise intruded into the control board, causing the memory circuit to malfunction and destroying the memory. | ● Use appropriate noise preventive measures.<br>→ Review grounding circuit.<br>→ Review power supply ··· Do not share a power supply with other equipment that would cause power fluctuation such as air compressors.<br>→ Do not install the unit near a welding machine or other noise-producing equipment.<br>→ Also refer to "9.2.4. Measures Against Noise." |
| ● Power failed when rewriting the memory. | ● Use a stable power supply. |
| ● The exhausted battery was not replaced. | ● Replace battery when battery alarm is issued. |


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 20.4.9. Memory Error 2

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo off | 0E01 | open | open | Memory 2 |

- The data in the memory are sum-checked on making power and periodically thereafter. An alarm is issued on detecting an error. The Memory Error 2 checks the memory for the program/teaching point register.
- When this alarm occurs, the EXC controller stops immediately and the motor enters the servo off state.
- Initialize the memory and then write the program and teach the system.
  - → When the alarm occurs on making power, you may initialize the memory on the teaching box (see "10.1.2. Checking Points When Turning on Power."
  - → When the alarm occurs after making power, initialize the memory referring to "21.3.1 Memory Initialize."
  - → For alarms occurring in the remote control mode, see "15.5. Abnormal Response."

*Table 20-11*

| Cause | Action |
|---|---|
| • A large rush noise intruded into the control board, causing the memory circuit to malfunction and destroying the memory. | • Use appropriate noise preventive measures.<br>→ Review grounding circuit.<br>→ Review power supply ··· Do not share a power supply with other equipment that would cause power fluctuation such as air compressors.<br>→ Do not install the unit near a welding machine or other noise-producing equipment.<br>→ Also refer to paragraph "9.2.4. Measures Against Noise". |
| • Power failed when rewriting the memory. | • Use a stable power supply. |
| • The exhausted battery was not replaced. | • Replace battery when battery alarm is issued. |

## 20.4.10. Low Battery Voltage

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo off | 0E05 | close | close | Battery |

- An alarm is issued when the battery voltage drops to 2.2 V or less (normal voltage is 3.3 V or above).
- The memory is retained despite the alarm if you do not shut off power to the EXC controller. Replace the battery as soon as a new battery is ready.
  - → See "19.2.2.2. Periodical Replacement, Replacing Lithium Battery."

*Caution : The memory is lost when you shut off power in the state of this alarm. Do not shut off power until you replace the battery.*

- The EXC controller continues normal operation despite this alarm.

*Table 20-12*

| Cause | Action |
|---|---|
| • Low battery voltage. | • Replace battery. |
| • Defective contact and fitting, and break of battery connector. | • Correct, or replace battery. |
| • Battery voltage detecting circuit failed. | • Replace controller.<br>→ Contact your local NSK representative. |


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 20.4.11. CPU Error

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo off | Indefinite/0E66 | open | open | Retain previous display/CPU |

- CPU runaway is monitored by a watchdog timer and other monitor circuits.
- An alarm is issued when no response is received from the CPU for more than 10 ms.
- There are two types of CPU alarms with different displays.

① System control CPU error : The 7-segment LED display is indefinite. The teaching box keeps the previous display but "Impossible to communicate" message appears when any operation is attempted on the teaching box.

② Servo computing CPU (DSP) error : The 7-segment LED displays 0E06 and teaching box displays CPU1 through CPU4.

*Table 20-13*

| Teaching box display | Description |
|---|---|
| CPU1 | DSP don't raise when the power is turned on. |
| CPU2 | DSP processing is not completed. |
| CPU3 | DSP state response failed. |
| CPU4 | DSP watchdog timer failed. |

- When this alarm occurs, the EXC controller stops immediately and the motor enters the servo off state. A temporary runaway is reset by remaking power. If the system does not reset, a hardware failure is suspected.

*Table 20-14*

| Cause | Action |
|---|---|
| • A large rush noise intruded into the control board, causing CPU runaway. | • Turn on power again.<br>• Use appropriate noise preventive measures.<br>→ Review grounding circuit.<br>→ Review power supply ··· Do not share a power supply with other equipment that would cause power fluctuation such as air compressors.<br>→ Do not install the unit near a welding machine or other noise-producing equipment.<br>→ Also refer to "9.2.4. Measures Against Noise." |
| • CPU or watchdog timer circuit failed. | • Replace controller.<br>→ Contact your local NSK representative. |



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 20.4.12. System Mismatch

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo off | 0E07 | open | open | System type |

- This alarm will not occur in normal operation.
- This may occur when, for example, it was found in system check on tuning power on that "this is a 2-axis system, but 3-axis system parameters were written."
- The unit may not be operated in this state. To recover, initialize the memory and then execute initialization, write the program and teach the system again.
  - → When the alarm occurs on turning power on, you may initialize the memory on the teaching box. (see "10.1.2. Checking Points When Turn on Power.")
  - → When the alarm occurs after turning on power, initialize the memory referring to "21.3.1. Memory Initialize."
  - → For alarms occurring in the remote control mode, see "15.5. Abnormal Response."

## 20.4.13. Excessive Position Error

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo off | *n* F01 | open | open | POS. err |

- An alarm is issued when the position error counter exceeds the preset difference level. The difference level is set by the "POS.err" limit parameter in the initial setting. See "11.5.1. Position and Coordinate Parameters."
- This alarm tells the operator that position control did not work properly for some reason (mechanical lock on the module main unit side, etc.).
- When this alarm occurs, the EXC controller stops immediately and the motor enters the servo off state.

*Table 20-15*

| Cause | Action |
|---|---|
| • POS.err.limit parameter setting error = setting value too small. | • Set correctly.<br>→ Reset to the factory set values. |
| • Gain setting error.<br>* This alarm tends to occur frequently if the gain is set too low. It will not occur, however, unless the gain setting is extremely deviated. | • Optimize adjustments.<br>→Reset to the factory set value if the load is not large.<br>→ Increase gain if the load is large. |
| • The brake of the module main unit is not released. See "21.2.2. Confirming Brake Control Function."<br>* In this instance, an overload alarm may occur first. See the paragraph for overload alarm. | • Release the brake. |
| • The module main unit is interfered or failed. | • Check the load weight, motor lock, load interference, etc. when the inverse motion actually occurred. Identify the cause, and correct or replace as required. See "21.2.3. Confirming Back Drive Force of Mechanism." |
| • Motor output is not as designed.<br>→ Example: 100 V power was connected to a 200 V unit. | • Check the specifications and correct or replace as required. |
| • Motor does not start.<br>→ Example: Mis- or non-wiring, or break of motor cables. | • Check cables and correct or replace as required. |


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 20.4.14. Software Travel Limit

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo lock (one direction) | *n* F02 | close | close | OT (soft) □* |

* □ indicates the axis for which the alarm occurred: X, Y, Z or R.

- An alarm is issued when the slider travels (= motor rotates) beyond the software travel limit. The software travel limit is set by the Overtravel parameter in the initial setting. See "11.5.1. Position and Coordinate Parameters."
- The alarm is not issued if an effective value is not set for the Overtravel parameter. The unit is set to "no function" at the factory.
- This alarm is invalid unless Home Return is completed and the coordinates are defined.
- When the alarm occurs, the EXC controller stops immediately and the motor enters the servo lock state despite the command to travel further in the direction of the limit. The system in this state will accept a command to travel in the opposite direction. To exit from the limit area, instruct a command (jog, etc.) to travel in the opposite direction.

*Table 20-16*

| Cause | Action |
|---|---|
| ● Overtravel parameter setting error. | ● Set correctly, or disable software overtravel. |
| ● Current position is in the software overtravel area. | ● Exit from the limit area. |

## 20.4.15. Hardware Travel Limit

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo lock (one direction) | *n* F03 | close | close | OT□* |

* □ indicates the axis for which the alarm occurred: X, Y, Z or R.

- An alarm is issued when the travel limit switches installed on either side of the module main unit are turned off.
- When the alarm occurs, the EXC controller stops immediately and the motor enters the servo lock state despite the command to travel further in the direction of the limit. The system in this state will accept a command to travel in the opposite direction. To exit from the limit area, instruct a command (jog, etc.) to travel in the opposite direction.

*Table 20-17*

| Cause | Action |
|---|---|
| ● Travel limit switch was deactivated. | ● Exit from the limit area. |
| ● Travel limit switch inputs do not reach the EXC controller.<br>Example 1: Mis- or non-wiring of limit switches or break of wires.<br>Example 2: Failed limit switch or broken internal wiring. | ● Check controller and robot cables (including user-supplied cables in the case of pulse train output axis). Correct or replace as required.<br>● When the Example 2 case is suspected, replace the main unit.<br>→ Contact your local NSK representative. |
| ● Defects on the EXC controller side.<br>Example 1: Failed limit switch signal receiving circuit.<br>Example 2: Failed limit switch power circuit.<br>* An encoder wiring break alarm may occur simultaneously in the case of Example 2. | ● Replace controller board.<br>→ Contact your local NSK representative. |
| ● A hardware travel limit alarm is given from the pulse train output axis even the pulse train output function is not in use. | ● Disable pulse train output function (Pulse Out parameter set to 0). See "16.3.2. Setting Pulse Train Output Function." |


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 20.4.16. Emergency Stop

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo off | *n* F04 | open | open | EMST |

- The system enters the emergency stop state and an Emergency Stop alarm is output as you perform the emergency stop operation for the EXC controller.

* See "18.3.1. Emergency Stop."

*Table 20-18*

| Cause | Action |
|---|---|
| • Commanded an emergency stop operation. | • Reset emergency stop operation, and reset alarm or remake power. See "20.5. Alarm Reset Function" for the alarm reset operation. |
| • The emergency stop state occurred when no emergency stop operation was commanded, or the emergency stop state can not be reset. | |
| Example 1: Mis- or non-wiring or break of CN2•EMST input. | • Check and correct wiring. |
| Example 2: For a rack mount type EXC controller, 24 VDC power source for CN2 is not supplied or EMST input is in the off state due to mis-wiring. | • Check and correct 24 VDC power and wiring. |
| Example 3: For a rack mount type EXC controller, the system determines EMST input is off because the rise of 24 VDC power for CN2 is later than the EXC controller. | • Check 24 VDC power, or check power start-up sequence. |
| Example 4: Teaching box disconnected, or the EMST switch in the teaching box failed. | • Replace teaching box. |
| Example 5: EMST line malfunction due to effect of external noise. | • Noise preventive measures: See paragraph "9.2.4. Measures Against Noise." |
| Example 6: Internal circuits of the EXC controller failed. | * See "21.1.8. Unable to Reset Emergency Stop." |



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 20.4.17. Program Error

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo off | *n* F05 | close | close | See Table 20-19 |

- An alarm is issued when the system encounters a program command which is grammatically errored or can not be executed.
- When the alarm occurs, the EXC controller stops operation immediately and the motor stops in the servo lock state. Reset the alarm (see "20.5. Alarm Reset Function"), identify the cause, and correct the program (review "13.2. Programming" once again).

*Table 20-19: Program Error*

| Teaching box display | Cause |
|---|---|
| Prog not found | • Attempted to execute an empty program. |
| Step not found | • Program stops halfway (no End command at the end of the program). |
| Axis mismatch | • For a circular/arc interpolation, coordinate data for 3 axes or more are set on point register, or coordinate data are available only for one axis (impossible to perform 2-axis circular interpolation). |
| Data range over | • For VEL/ACC commands, data exceeding 100% are set.*<br>• Data were output by an OUT command to output port No. 3 when the pulse train output function is enabled (output port No. 3 may not be used as a general output when the pulse train output function is enabled. See "16. Pulse Train Output Function"). |
| Undefind TAG | • The specified TAG No. to jump to does not exist in the same program. |
| Duplicate TAG | • The specified TAG No. to jump to exist in the same program in multiple lines. |
| Too many CALL | • For a CALL command, loop duplication is 5 or more (allowable nesting groups are 4 or less). |
| Without CALL | • Attempted to execute REP command when CALL command is not set. |
| Too many REP | • For a REP command, loop duplication is 5 or more (allowable nesting groups are 4 or less). |
| Without REP | • Attempted to execute NXT command when REP command is not set. |
| Can't make cir | Circular/arc interpolation can not be performed because:<br>• Too small (1 mm or less) or too large radius (5000 mm or more). (Circular/arc interpolation may not be performed in the threshold range due to internal computation error.)<br>• No circle or an arc is drawn including the specified 3 points (Example: a straight line is formed, etc.).<br>• Current position and circle/arc starting position are different.<br>• Attempted a circular/arc interpolation for 3 axes or more (3-dimensional or more circular/arc interpolation is not permitted). |
| Servo off | • Attempted a move command in the servo off state.<br>→ Set the system to servo on state and retry. |
| Axis off line | • A non-existent axis is set.* |
| Pallet empty | • Attempted a palletize program in which Initialize (PAL00) or Loading command (PAL01) is not set. |
| Too many CALP | • For a CALP command, loop duplication is 5 or more (allowable nesting groups are 4 or less). |
| Without CALP | • Attempted a RETP command when CALP command is not set. |
| Data overflow | • Data overflow after execution of a computation command. |
| Data mismatch | • With a computation command, attempted a computation between non-computable data.* |
| Origin not executed | • Attempted a move command without completing Home Return.<br>→ Complete Home Return and then retry. |
| Without interrupt | • Attempted IRET command while not in an interrupt process. |
| Int. Prog not found | • Interrupt occurred, but the interrupt process program is empty. |

* These alarms will not occur in the normal operation. If they should occur, memory initialization and re-programming are necessary. See "21.3.1. Memory Initialize."


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

*(Program Error - continued)*

| Teaching box display | Cause |
|---|---|
| Can't make path | Unable to perform continue path move because:<br>→ Review "13.2.4.5. Continue Path."<br>● Coordinate data for 3 axes or more are set for point data used in continue path move (continue path move is limited to 2-dimensions).<br>● 101 or more commands are set between CPS and CPE.<br>● 4 or more consecutive OUT commands are set.<br>● The move command includes a smooth sine acceleration/deceleration (S command) or continuous move (N command). (These may not be designated during a continue path move.)<br>● A command(s) other than MOV, CIR, ARC and OUT is set.<br>● The first move command is not a linear move = The starting command is a CIR or ARC command.<br>● The last move command is not a linear move = The ending command is a CIR or ARC command. |
| Can't make path(a) | ● Acceleration does not complete in the first MOV command.<br>→ Extend acceleration distance or increase acceleration/deceleration. |
| Can't make path(v) | ● The designated travel speed is not achieved.<br>Example: A travel speed requiring a speed above 600 mm/s is set for an axis of ball screw lead 10 mm.<br>→ Decrease the setting speed. |
| Can't make path(d) | ● Deceleration does not complete in the last MOV command.<br>→ Extend deceleration distance or increase acceleration/deceleration. |
| Without CPS | ● Attempted a CPE command in the absence of a CPS command. |
| Undefind command | ● Non-existent program commands are set.* |
| Can't restart prog | Program can not be restarted halfway because:<br>● Cycle stop does not complete when the program is interrupted = Attempted program restart from halfway without finishing a step.<br>● Attempted program restart from halfway after closing the program (= equivalent to execution of END command) by resetting, emergency stopping (EMST), or forcibly stopping (STOP) the system in response to an alarm.<br>● Attempted program restart from halfway according to procedure not specified in this document.<br>● Attempted program restart from halfway when the specified conditions are not satisfied. |
| Restart prog not found | ● When restarting a program from halfway, an RSTA command is set but the restart initialize program designated by the RSTA command is empty. |

* These alarms will not occur in the normal operation. If they should occur, memory initialization and re-programming are necessary.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 20.4.18. Home Return Error in Pulse Train Output

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo off | *n* F06 | close | close | Origin err □* |

* □denotes the axis to which an alarm is issued: Z or R axis.

- The Home Return error alarm occurs when the pulse train output function is in use. Also refer to "16. Pulse Train Output Function."
- The alarm detects that the Home Return to be performed on the pulse train input unit side is not completed normally.
- Home Return error is determined and an alarm issued when HOME (CN7: Home Return completed) input is not turned on within one minute after the EXC controller closes the HOS (CN7: home return start) output.
- When the alarm occurs, the EXC controller immediately stops the Home Return motion, and the built-in servo driver axis motor stops in the servo lock state.

*Table 20-20*

| Classification | Cause | Action |
|---|---|---|
| Pulse train output function is not used | • Pulse train output function is not used but Pulse Out parameter is set to 1 in the initial setting. | • Set Pulse Out parameter to 0.<br>→ See "16.3.2. Setting of Pulse Train Output Functions." |
| Pulse train output function is used | • Pulse I/O mode parameter is set to 0 (a mode not to use CN7) in the initial setting. | • Set Pulse I/O mode parameter to 1. |
| | • CN7 break, mis-, or non-wiring. | • Check and correct wiring. |
| | • Failure at the pulse train input unit side, or mismatch of functions with the EXC controller side. | • Failed pulse train input unit. Check functions. |
| | • Failure of EXC controller internal circuits. | • Replace controller.<br>→ Contact your local NSK representative. |


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 20.4.19. Alarms of Pulse Train Output

| Motor state | 7-segment LED | DRDY output | WRN output | Teaching box display |
|---|---|---|---|---|
| Servo off | *n* F07 | open | open | Pulse ALM port □* |

* □denotes the axis to which an alarm is issued: Z or R axis.

- The pulse train output alarm occurs when the pulse train output function is in use. Also refer to "16 Pulse Train Output Function."

- The alarm detects that the pulse train input unit side issued an alarm. The alarm is output when the ALM3 or ALM4 (CN7: pulse train output alarm) input is turned off.

- When the alarm occurs, the EXC controller immediately stops, and the built-in servo driver axis motor stops in the servo off state.

*Table 20-21*

| Classification | Cause | Action |
|---|---|---|
| Pulse train output function is not used | • Pulse train output function is not used but Pulse Out parameter is set to 1 in the initial setting. | • Set Pulse Out parameter to 0.<br>→ See "16.3.2. Setting Pulse Train Output Functions." |
| Pulse train output function is used | • An alarm occurs on the pulse train input unit side. | • Remove cause of alarm on the pulse train input unit side. |
| | • Pulse train input unit has not been started up when the EXC controller is ready to determine an alarm. | • Review power source start-up sequence. |
| | • CN7 break, mis-, or non-wiring. | • Check and correct wiring. |
| | • Failure at the pulse train input unit side, or mismatch of functions with EXC controller side. | • Failed pulse train input unit. Check functions. |
| | • Failure of EXC controller internal circuits. | • Replace controller.<br>→ Contact your local NSK representative. |


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 20.5. Alarm Reset Function

- The alarm reset function is used to reset the alarms shown in Table 20-22.
- The alarms shown in Table 20-23 cannot be reset.
- The alarm reset function is used to reset the latch inside the controller. It will not remove the cause of the alarm. The alarm state will occur again if the cause is not removed.

*Caution : When an alarm occurs, identify and remove the cause of the alarm in the first place. The controller, robot or peripheral equipment may be damaged if alarm and reset are repeated without removing the cause of the alarm.*

*Table 20-22: Resetable alarms*

| Classification | Item | Led display | Teaching box display | Note |
|---|---|---|---|---|
| Alarms related to power amplifier | Heatsink overheat<br>Regenerative dump resistor overheat | nP00 | PA ovr heat | |
| | Abnormal main power voltage<br>○ Excessive voltage<br>○ Low voltage | nP01 | PA mot volt | |
| | Overcurrent | nP02 | PA ovr corr | |
| | Low control power voltage | nP03 | PA con volt | |
| Alarms related to motor | Encoder disconnection | nA00 | Encorder | • Home Return operation is necessary after the action to the alarm has been taken. |
| | Overload | 0A03 | Thermal | |
| Alarms related to control | Excessive position error | nF01 | Pos. err | • Clear data of the position error counter as well. |
| | Emergency stop | 0F04 | EMST | |
| | Program error | 0F05 | | |
| Alarms related to pulse train output | Home Return error on pulse train output | 0F06 | Origin err | • After removing the cause of alarm, Home Return operation of pulse train input axis is necessary. |
| | Alarms of pulse return output | 0F07 | Pulse ALM | |

*Table 20-23: Not resetable alarms*

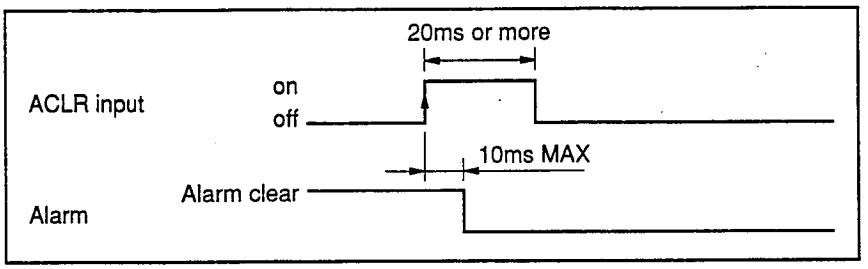
| Classification | Item | Led display | Teaching box display | Note |
|---|---|---|---|---|
| Alarms related to control | Memory error 1 | 0E00 | Memory 1 | • Initialize the memory. → See "21.3.1. Memory Initialize." |
| | Memory error 2 | 0E01 | Memory 2 | |
| | CPU error | – | – | • See "20.4.11. CPU Error." |
| | Low battery voltage | 0E05 | Battery | • Replace the battery. See "20.4.10. Low Battery Voltage." |
| | Software travel limit | nF02 | OT | • The alarms is automatically removed when the slider gets out from the over travel limit range. |
| | Hardware travel limit | nF03 | OT | |


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 20.5.1. Resetting Alarms in External Operation Mode (Operation Mode by CN2 Control I/O)

- The alarm is reset by the rise from Off to On at the CN2 pin 15 ACLR input.

*Figure 20-6*




## 20.5.2. Resetting Alarms in Teaching Box Operation Mode

- Press CLR and SET key to reset the alarm.
- Some alarms are reset by pressing only the CLR key while the others are reset by pressing the CLR key followed by the SET key within one second.

* Press and release the CLR key and then press the SET key. The alarm is not reset if both keys are pressed simultaneously.

*Table 20-24*

| Teaching box operation | CLR key | CLR key → SET key (within one second) |
|---|---|---|
| Alarms to be reset | • Excess position error<br>• Program error<br>• Home Return error | Other alarms shown in Table 20-22. |

## 20.5.3. Resetting Alarms in Remote Operation Mode (RS-232C Communication Mode)

- Alarms are reset by the ACLR and ACLR△ALL* command.
- The alarms reset by the ACLR and ACLR△ALL* commands, respectively, are shown in the following table.

*Table 20-25*

| Remote control | ACLR command | ACRL△ALL command* |
|---|---|---|
| Alarms to be reset | • Excess position error<br>• Program error<br>• Home Return error | Other alarms shown in Table 20-22. |

* : △ denotes space code (20H).



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# 21. Trouble Shooting

## 21.1. Description of Trouble Shooting

*Danger : Check the following before attempting trouble shooting. If these items are not observed, trouble shooting itself can be dangerous and further critical accident may occur due to secondary accidents such as motor burns and runaway.*

(1) Matching of module main unit and power amplifier.

- Check that the motor output specifications for the module main unit conform with the driver output specifications for the controller, and the main power voltage of the main unit with that of the controller.

  Example of error ①: X axis (300W axis) and Z axis (100w axis) are switched in connection.

  Example of error ②: A 100V main unit is connected to a 200V controller.

(2) We recommend to use NSK's standard controller cables.

- If you have provided the cables by yourself or modified the originals, check that there is no mis-wiring.

  Example of error ①: System runaway may occur if U,V and W wires of the motor power line are wrongly connected.

  Example of error ②: System runaway may occur if encoder signal lines are wrongly connected.

(3) Check that supply voltage is correct.

- ○ EXC□□A□□□A□□ : AC180V~242V, single-phase
- ○ EXC□□A□□□C□□ : AC90V~121V, single-phase

The driver unit may be burnt if the above voltage range is exceeded.

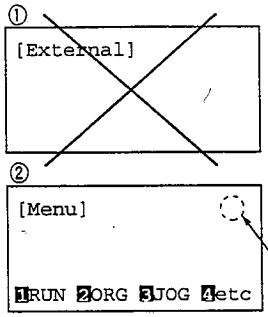
(4) Make sure that you did not erroneously connect the FG terminals and AC power lines. If the AC power is connected to the FG terminal, or to the ground, the controller may function improperly and burn out.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Danger : *Before attempting trouble shooting, check that the movable parts of the module main unit have completely stopped, set the system to the servo off state, and turn power off. This is necessary to prevent the operator being crushed, caughtor pulled in to the unit. If you must work with power on for an avoidable reason, take full safety measures referring to the following.*

- Set the controller to the teaching mode operation and at the same time set it to the servo off state. This is necessary to prohibit external servo on operation and driving of the unit.




: Check that the system mode selected is not the external operation mode.
Do not enter the area bound by the safety fences if the monitor shows display ①.

: Check that the servo on mark (*) on the upper right corner of the display is turned off.

- When you must perform servo on operation or operate the system while checking for an avoidable reason, make sure that no person and equipment that might be damaged are present in the robot working area. Also provide necessary means to prevent entry of other persons into the area while you are working.
- Keep the teaching box near the checker ready for immediate use in case of need.
- Before starting the work, test that the emergency stop state occurs as it should when you press the emergency stop key on the teaching box ( that is, you should start working after making sure that the emergency stop function will work properly).
- Do not touch the part of power supply line or amplifier where the electric shock hazard exists. Do not power on with covers open.

* The following description assumes that the above 4 items ((1) through (4)) have been correctly set and observed.

Warning : *When defective cables are suspected on a one axis, replace them with the correctly functioning axis. If you make an error in connection of a cable and an axis, improper functioning and motor burn may result.*

- Replace only the controller and robot cables. These cables are interchangeable.
- Do not change the combination of the 100 W axis (S module and S module vertical axis) and 300 W (H and M modules). Malfunctioning, complicated troubleshooting and motor burn may result.

  Example of errors: An S module main unit and an S module vertical axis (both being the 100 W motor axes) are connected to the 300 W output axes of the controller.

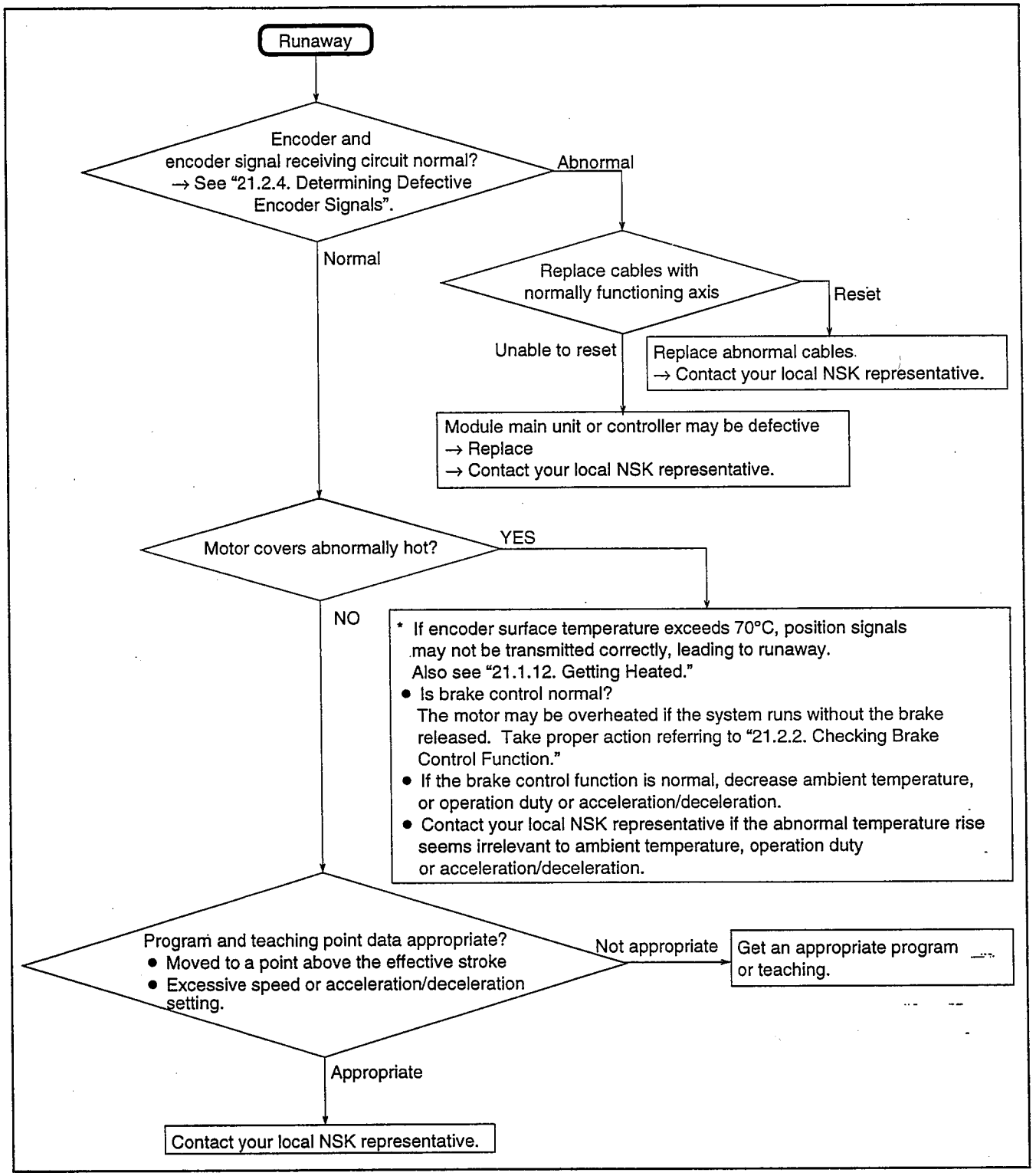

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.1.1. Runaway

★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

★ If, as a result of runaway ,the module main unit should crush against the stroke end or work severely, check the damage to the module main unit referring to "21.2.5. Action for Runaway and Collisions."

*Figure 21-1*



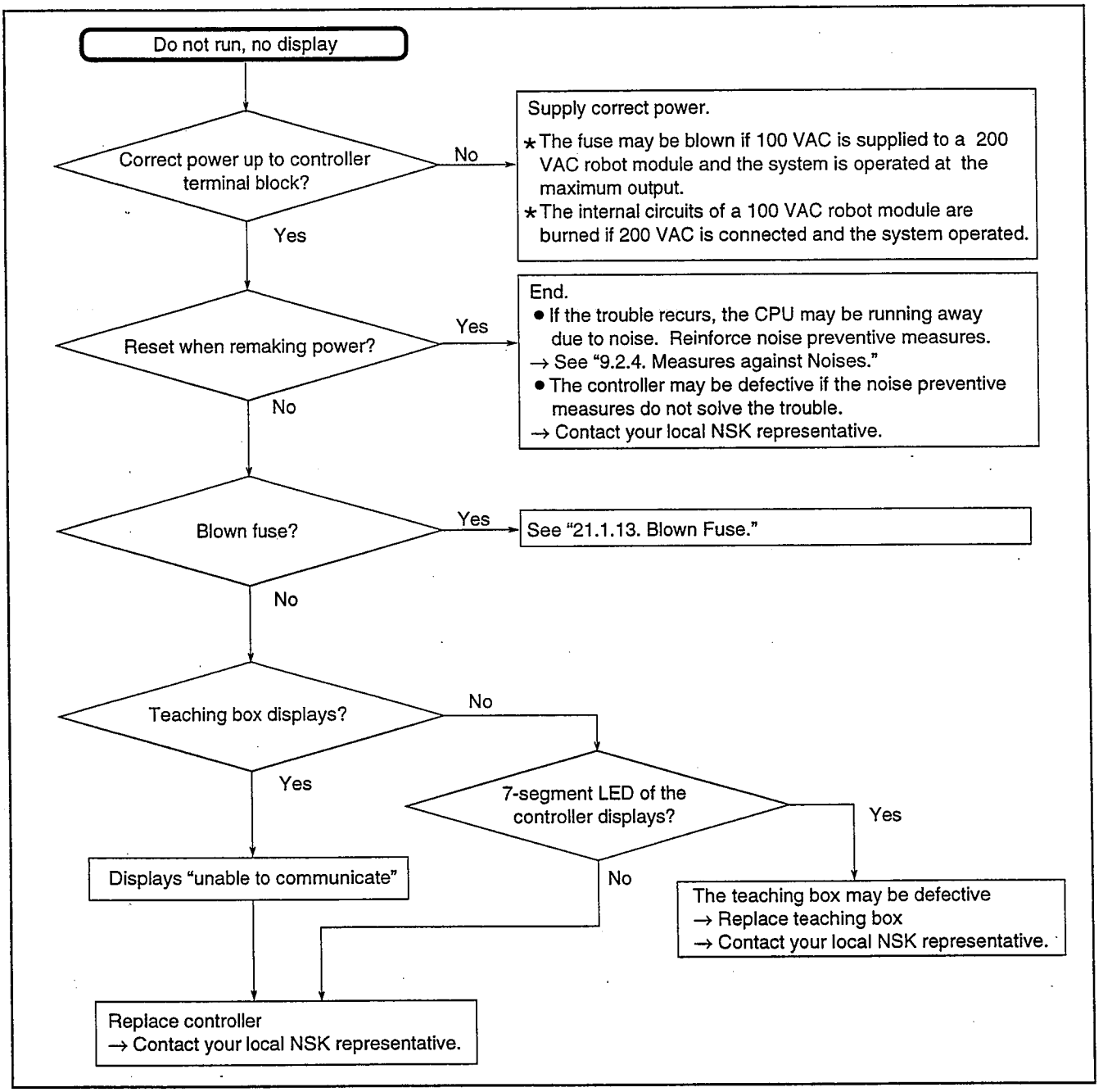


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.1.2. Unit does not Run Entirely

★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-2*

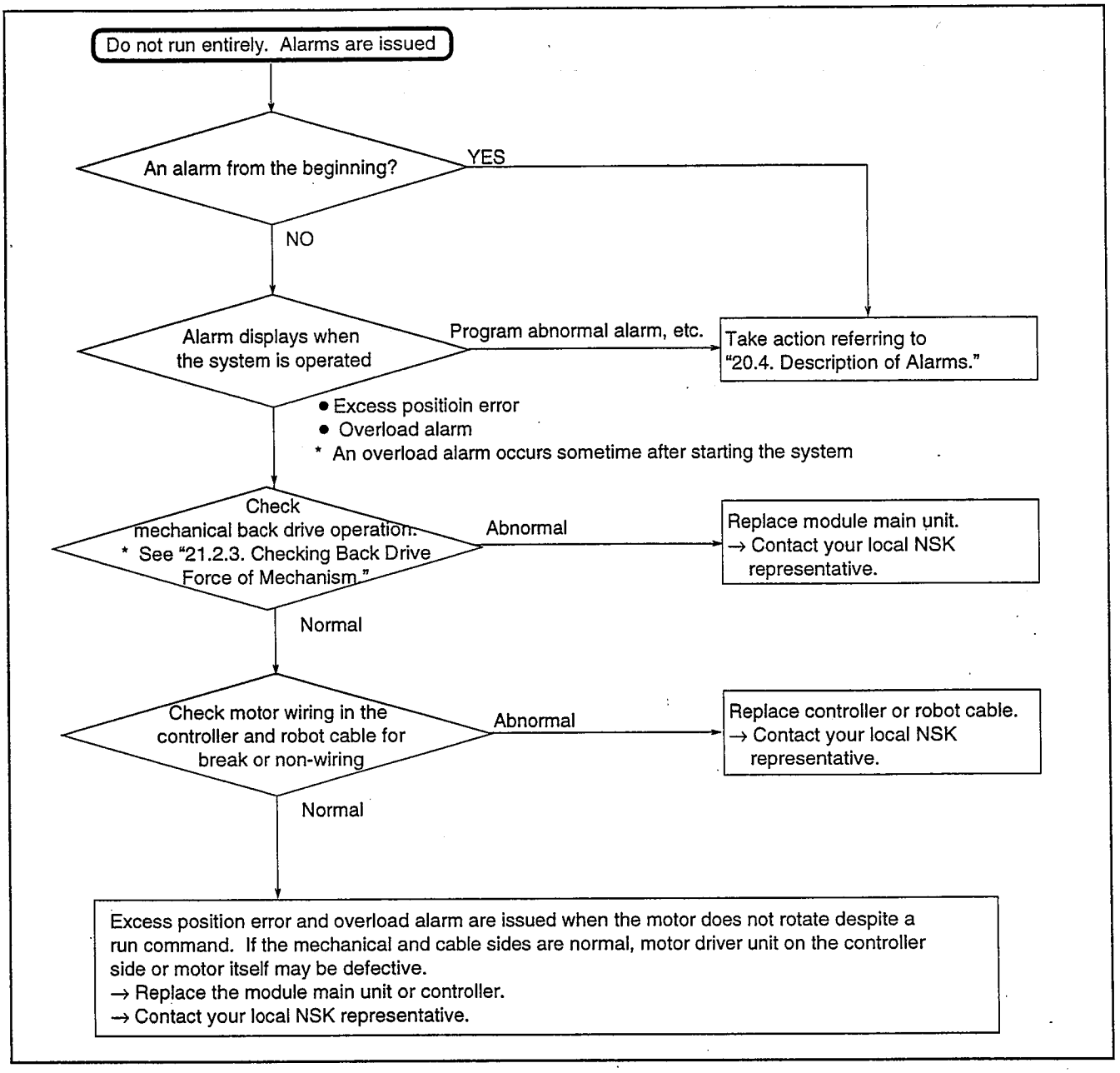





Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-3*

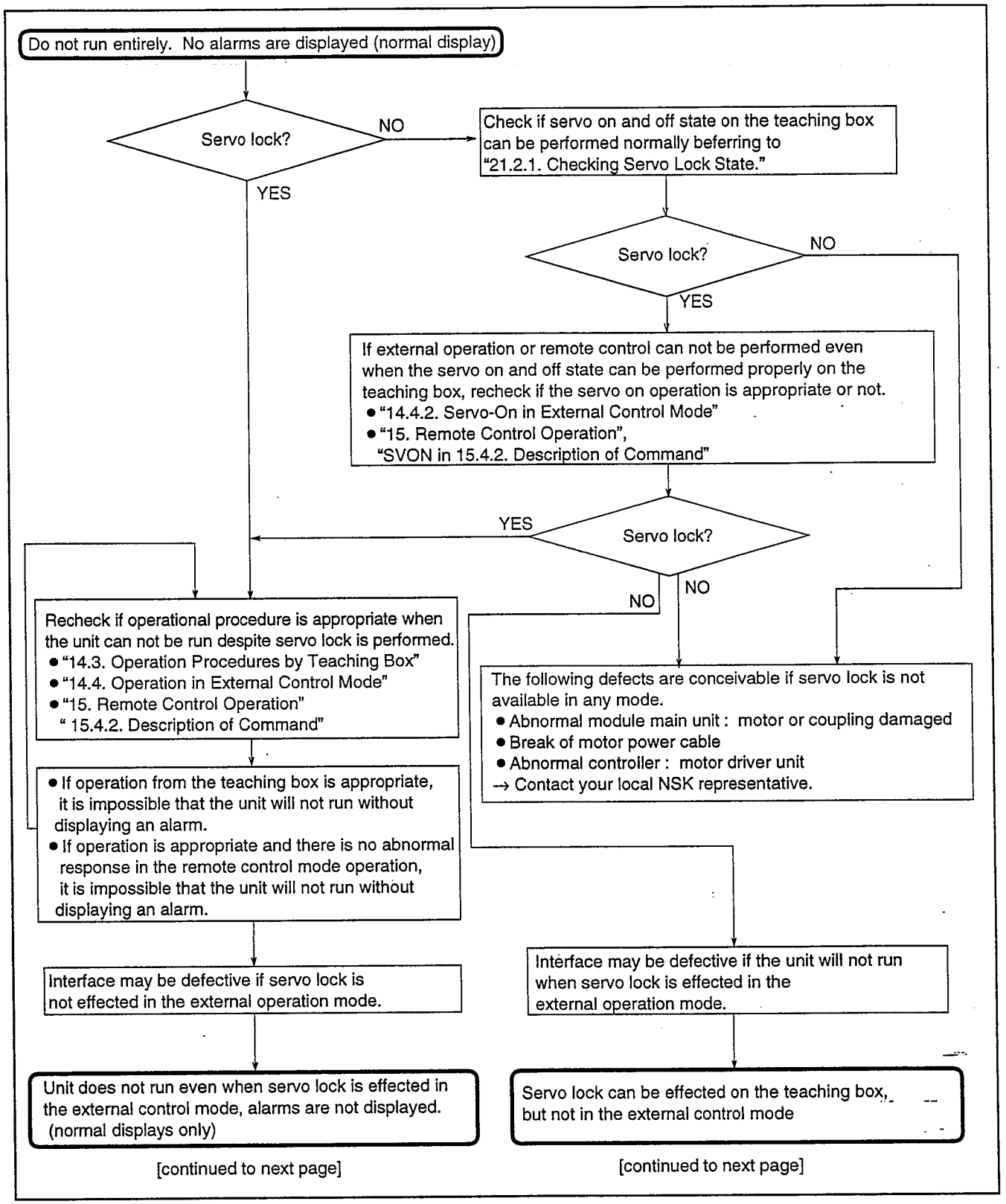





Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-4*




[continued to next page]

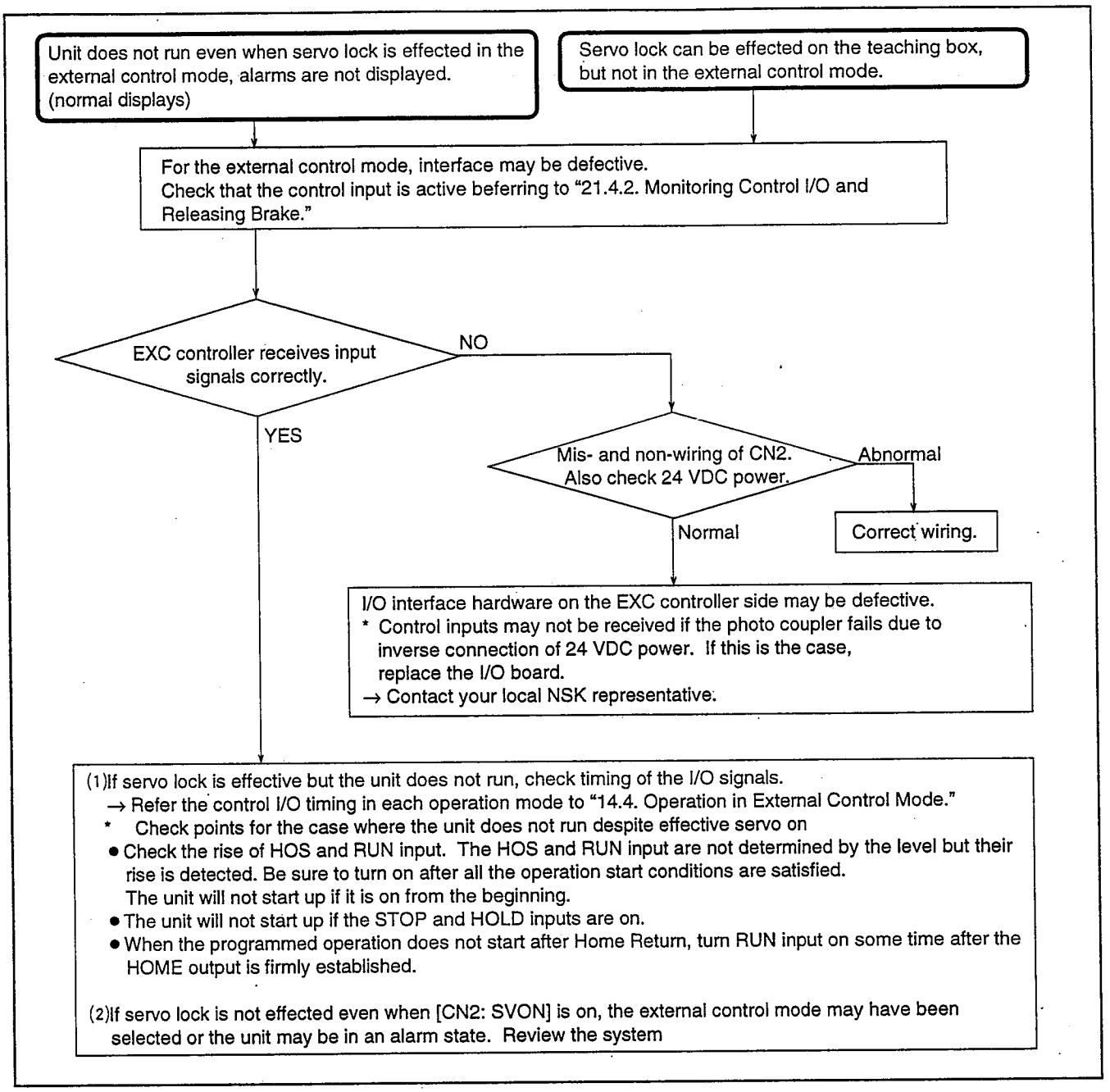
[continued to next page]



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-5*



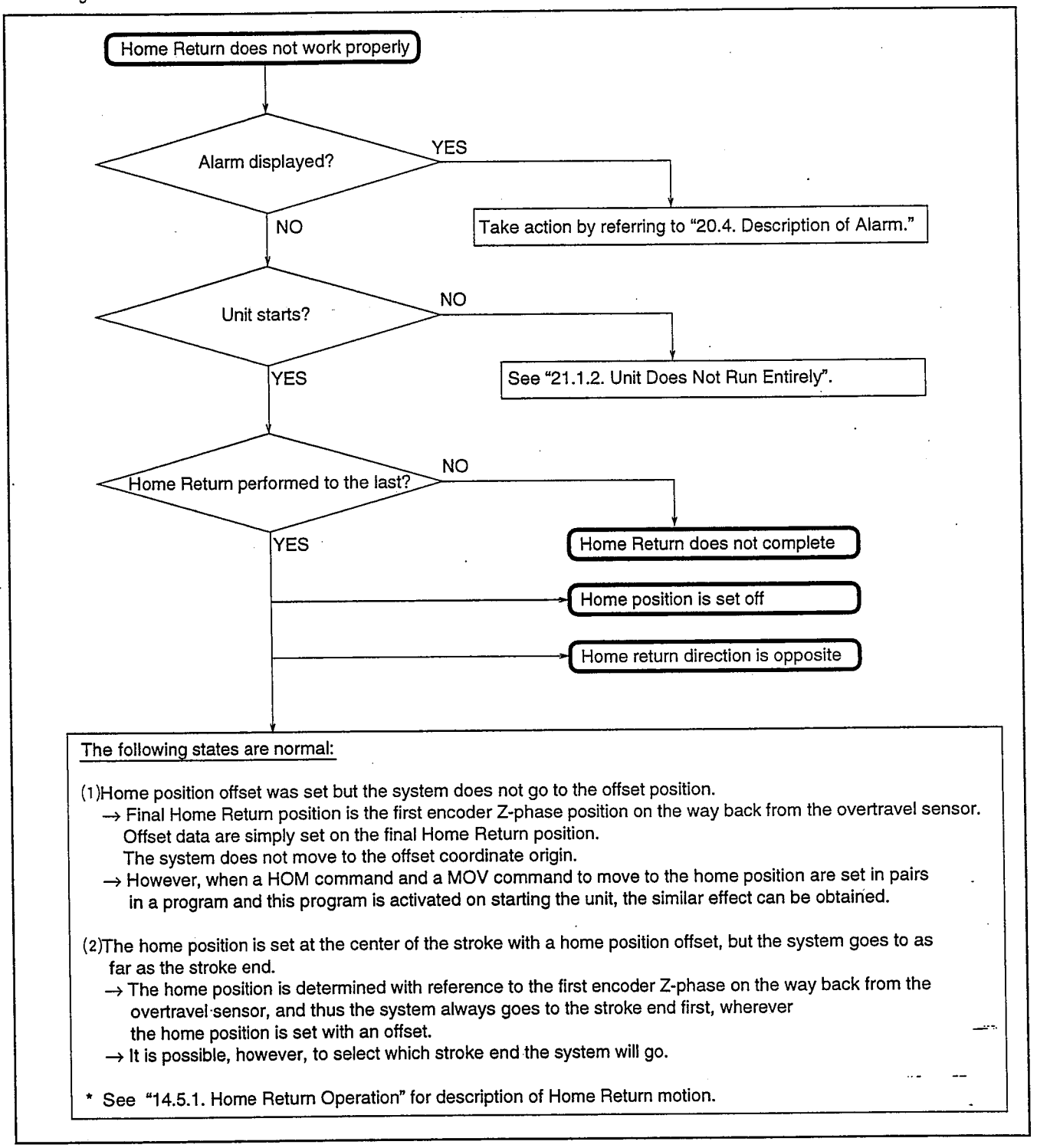


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.1.3. Home Return does not Work Properly

★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-6*




The following states are normal:

(1)Home position offset was set but the system does not go to the offset position.
→ Final Home Return position is the first encoder Z-phase position on the way back from the overtravel sensor. Offset data are simply set on the final Home Return position. The system does not move to the offset coordinate origin.
→ However, when a HOM command and a MOV command to move to the home position are set in pairs in a program and this program is activated on starting the unit, the similar effect can be obtained.

(2)The home position is set at the center of the stroke with a home position offset, but the system goes to as far as the stroke end.
→ The home position is determined with reference to the first encoder Z-phase on the way back from the overtravel sensor, and thus the system always goes to the stroke end first, wherever the home position is set with an offset.
→ It is possible, however, to select which stroke end the system will go.

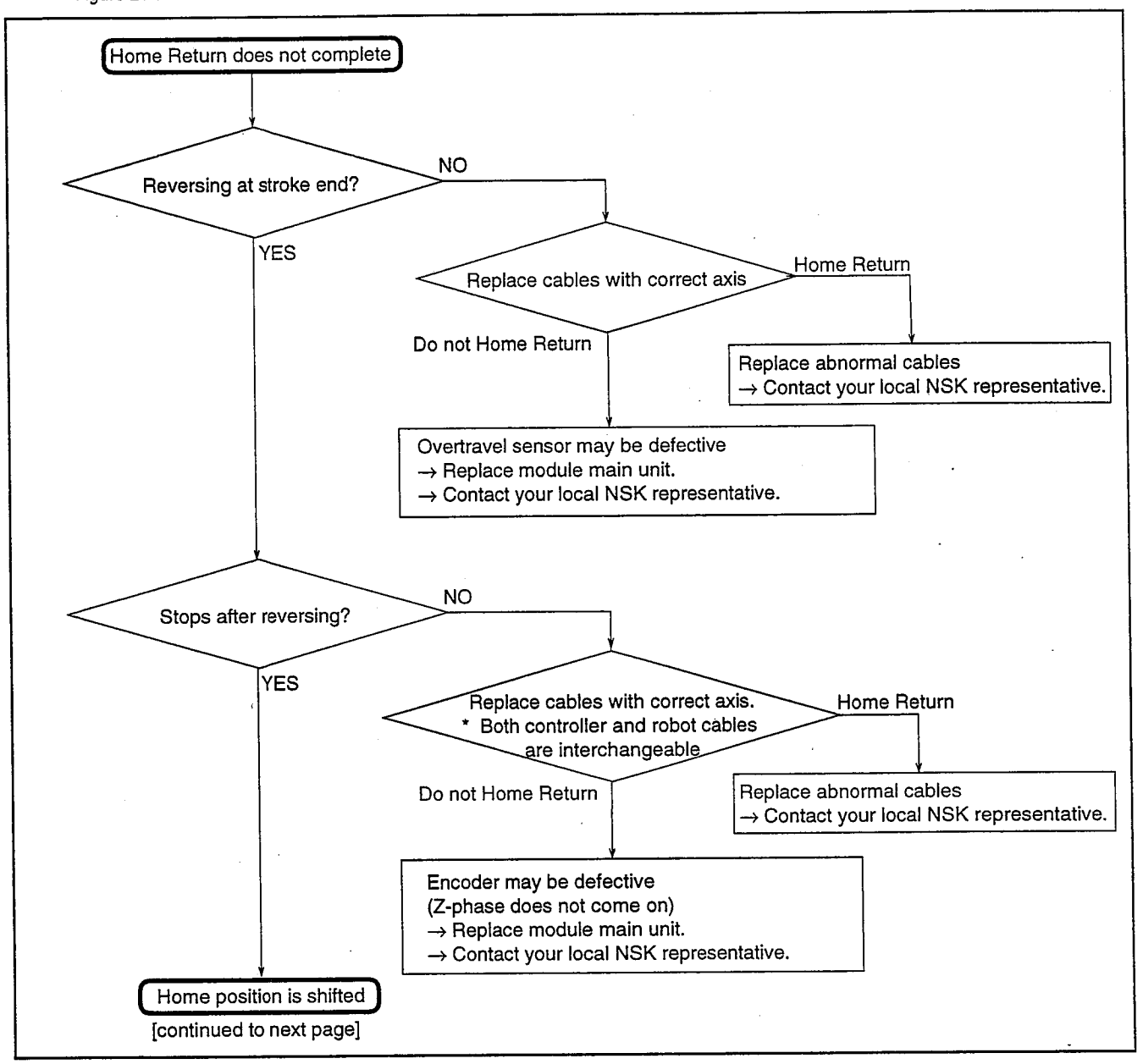
* See "14.5.1. Home Return Operation" for description of Home Return motion.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-7*



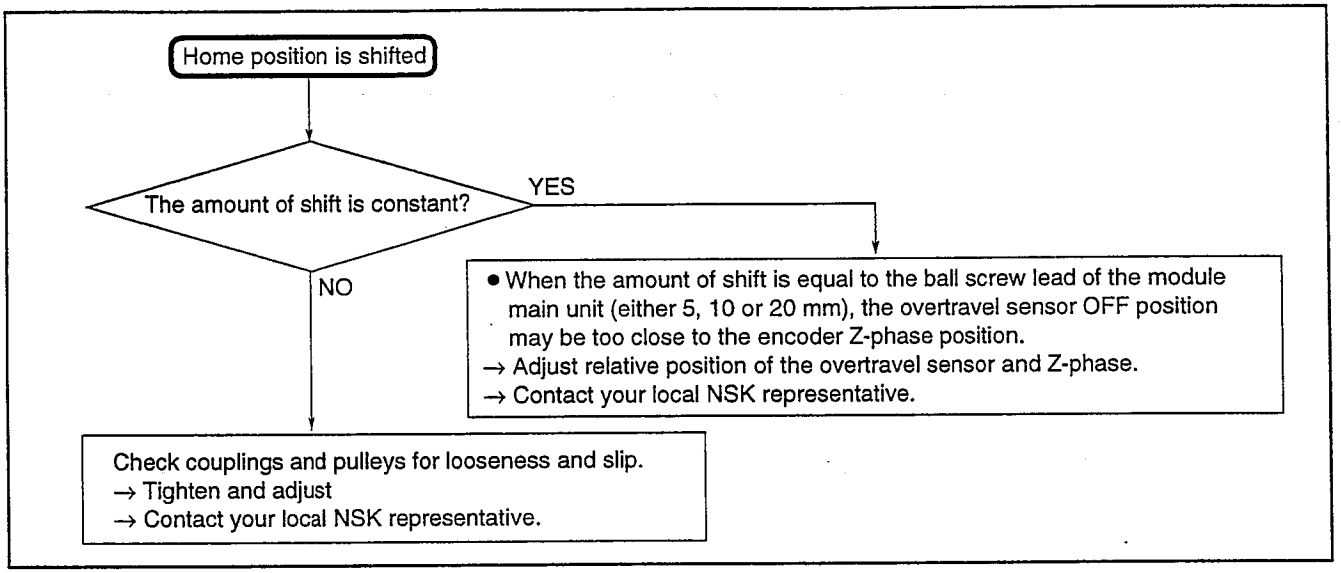

[continued to next page]



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

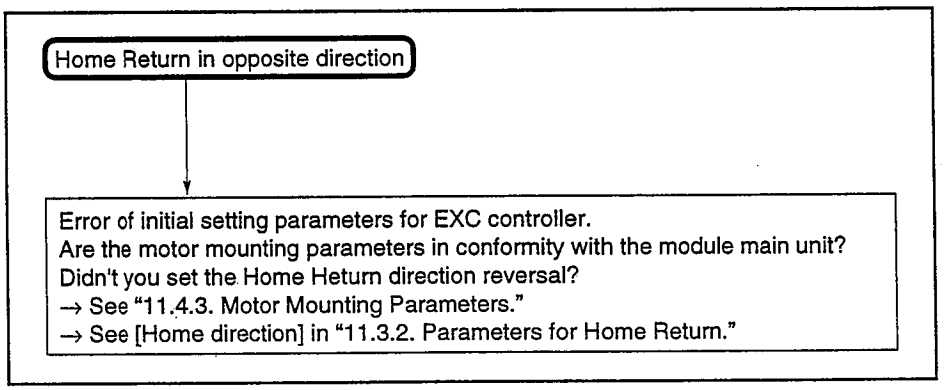
★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-8*




★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-9*



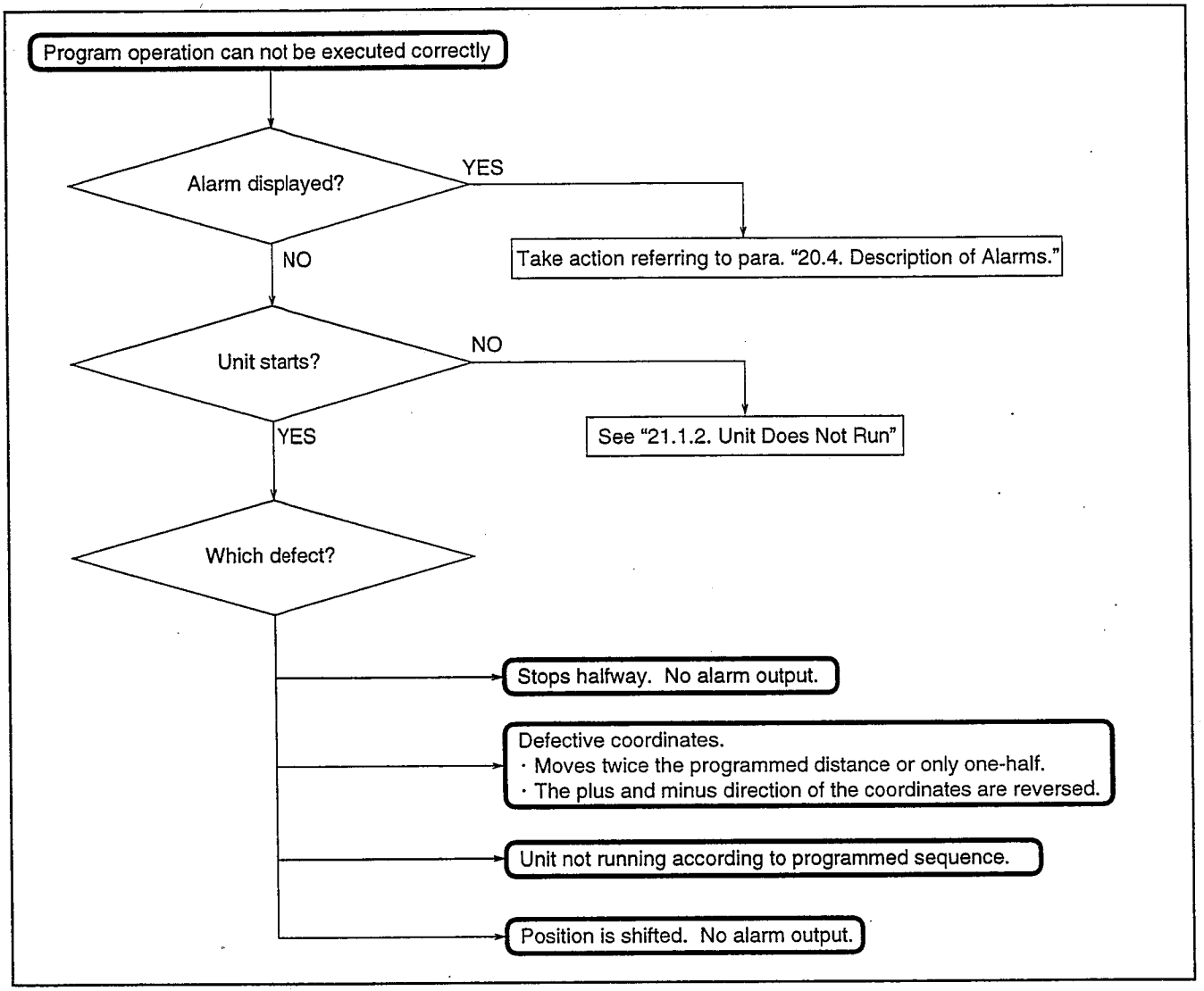



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.1.4. Program Operation can not be Executed Properly

★ Be sure to observe Danger and Warning instructions on

*Figure 21-10*

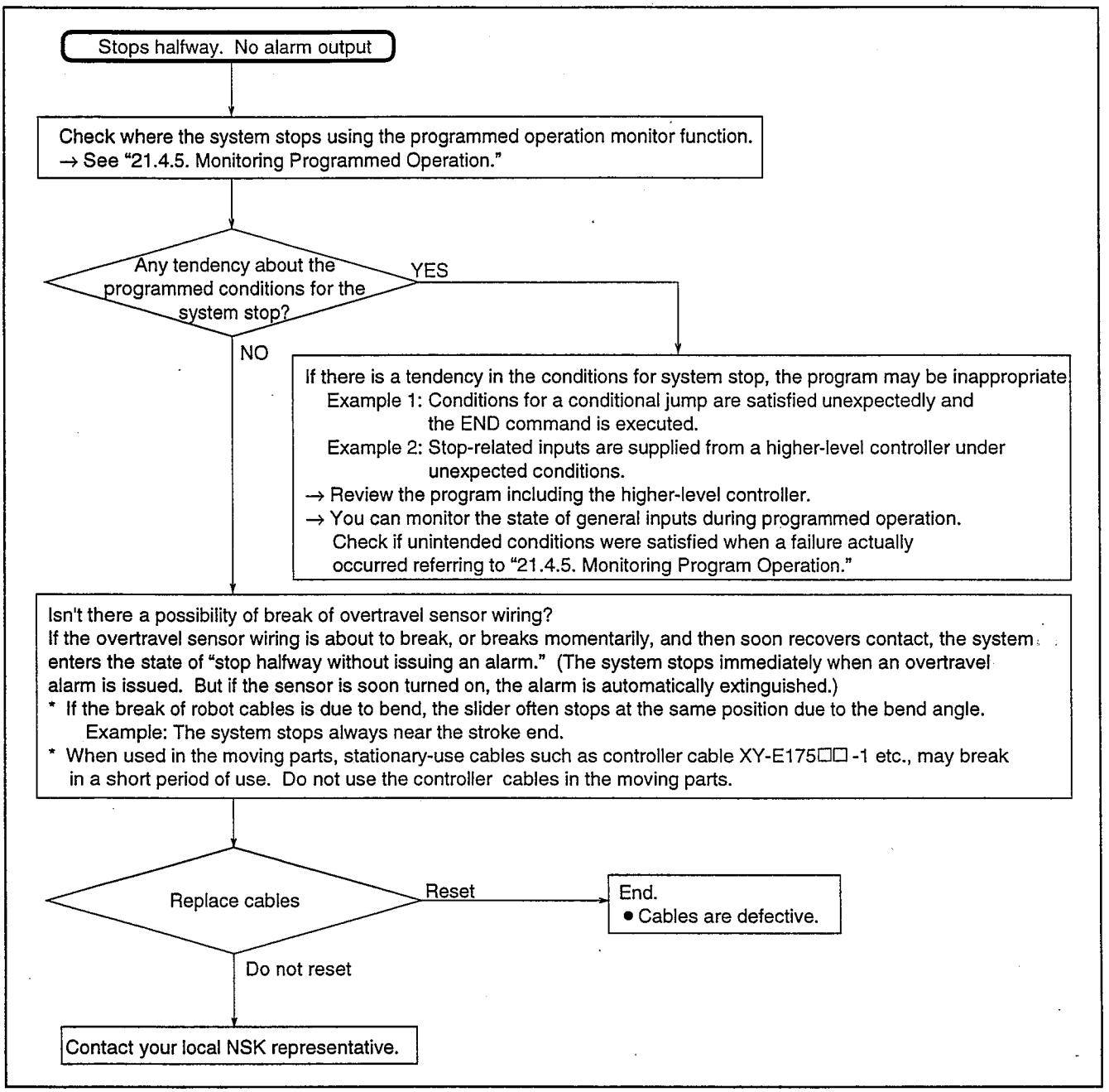





Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-11*

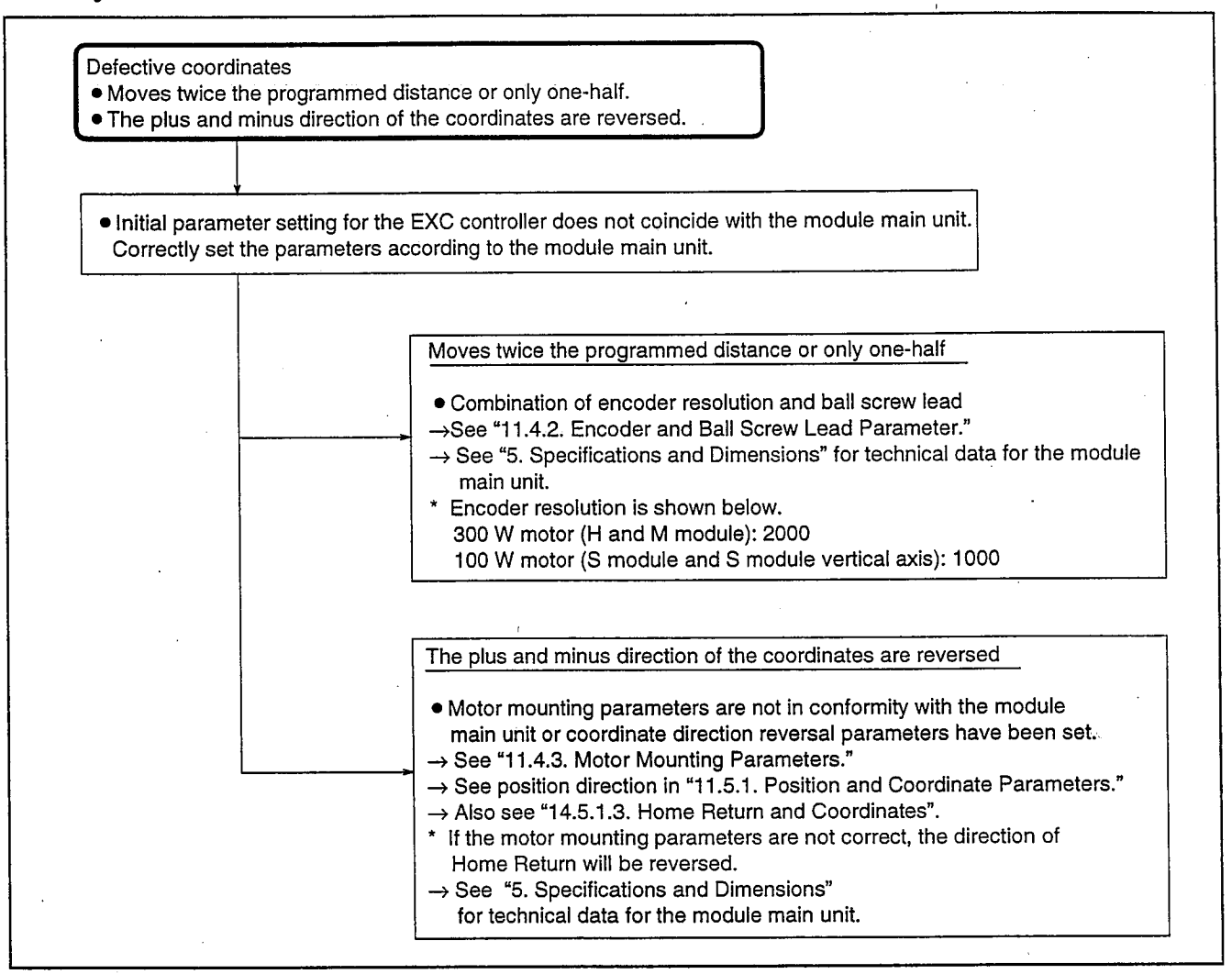





Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

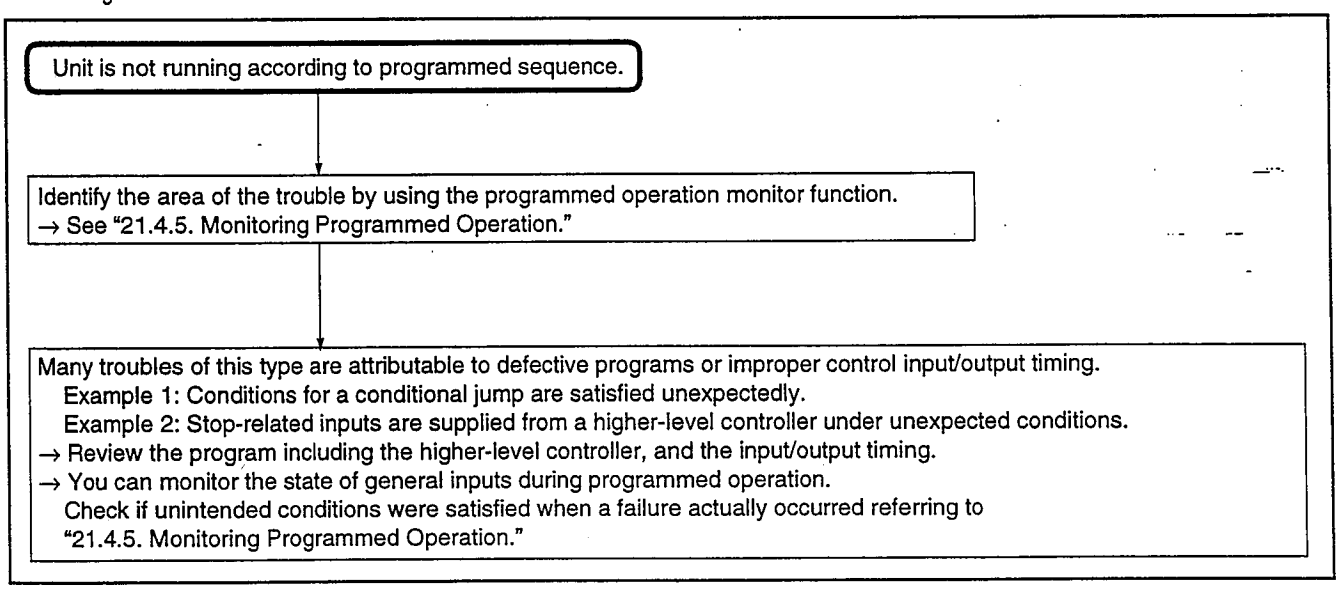
★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-12*




★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-13*

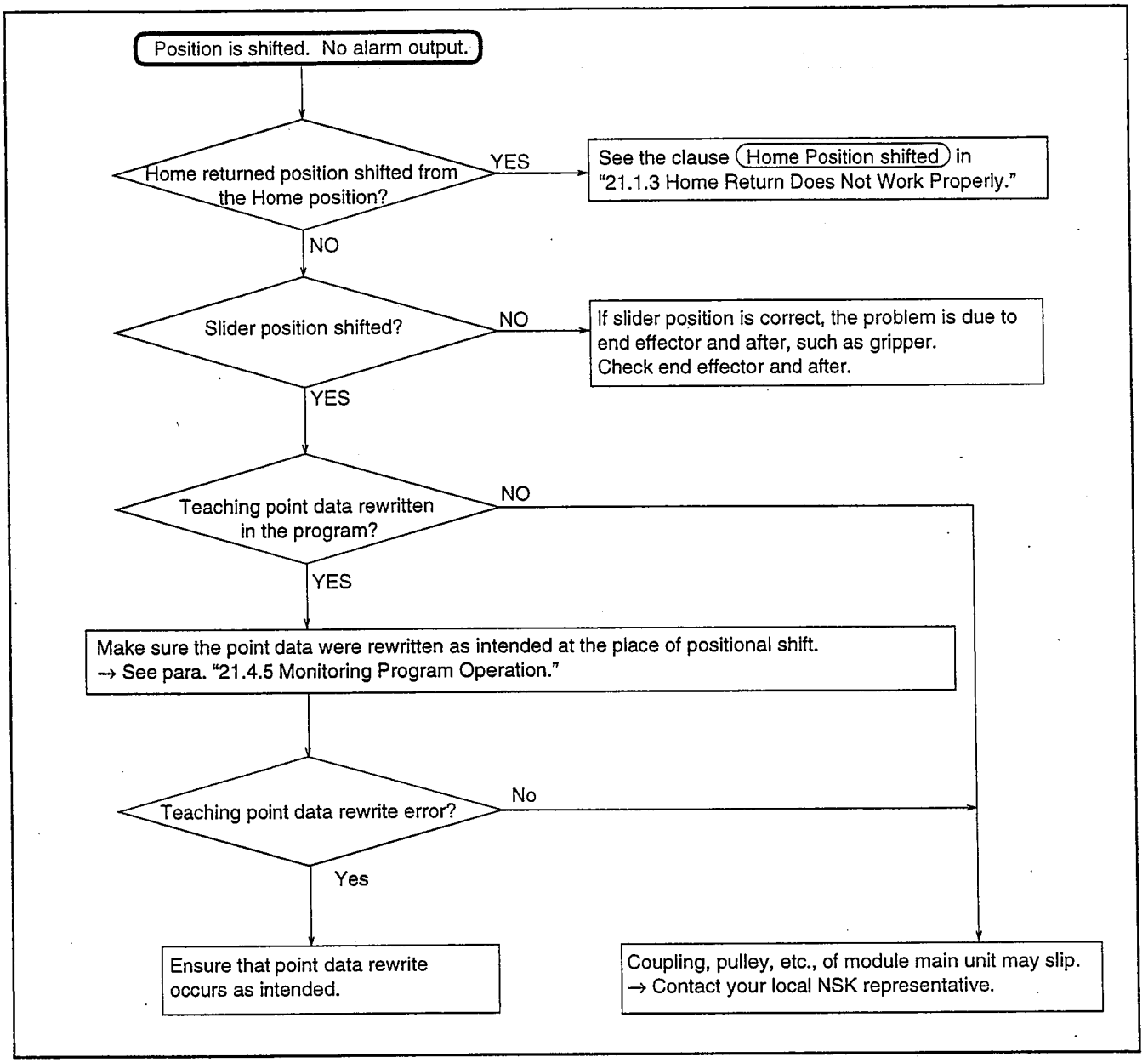




Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-14*



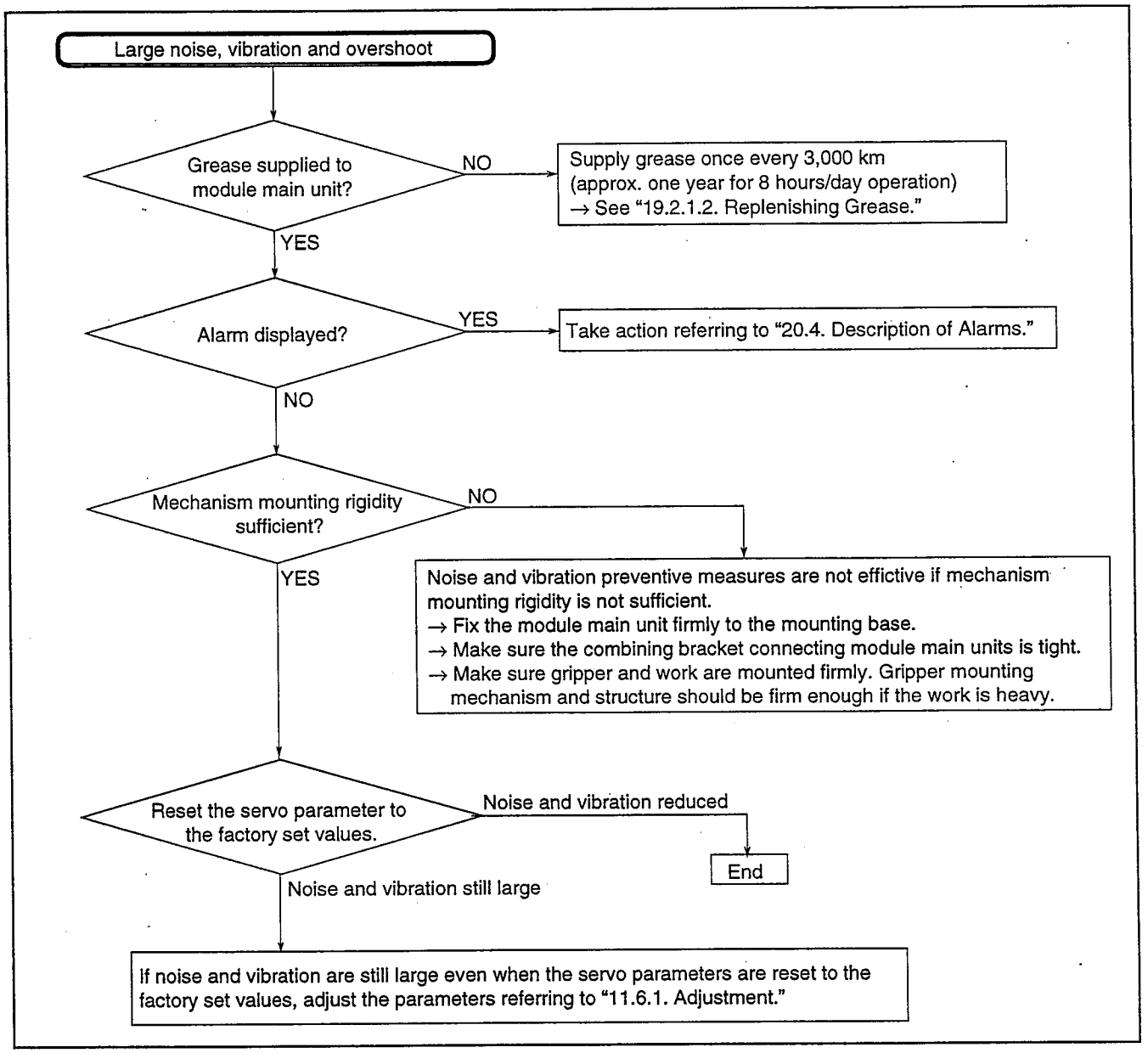



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.1.5. Large Noise, Vibration and Overshoot

★ Be sure to observe (Danger) and (Warning) instructions on pages 21-1 and 21-2.

*Figure 21-15*



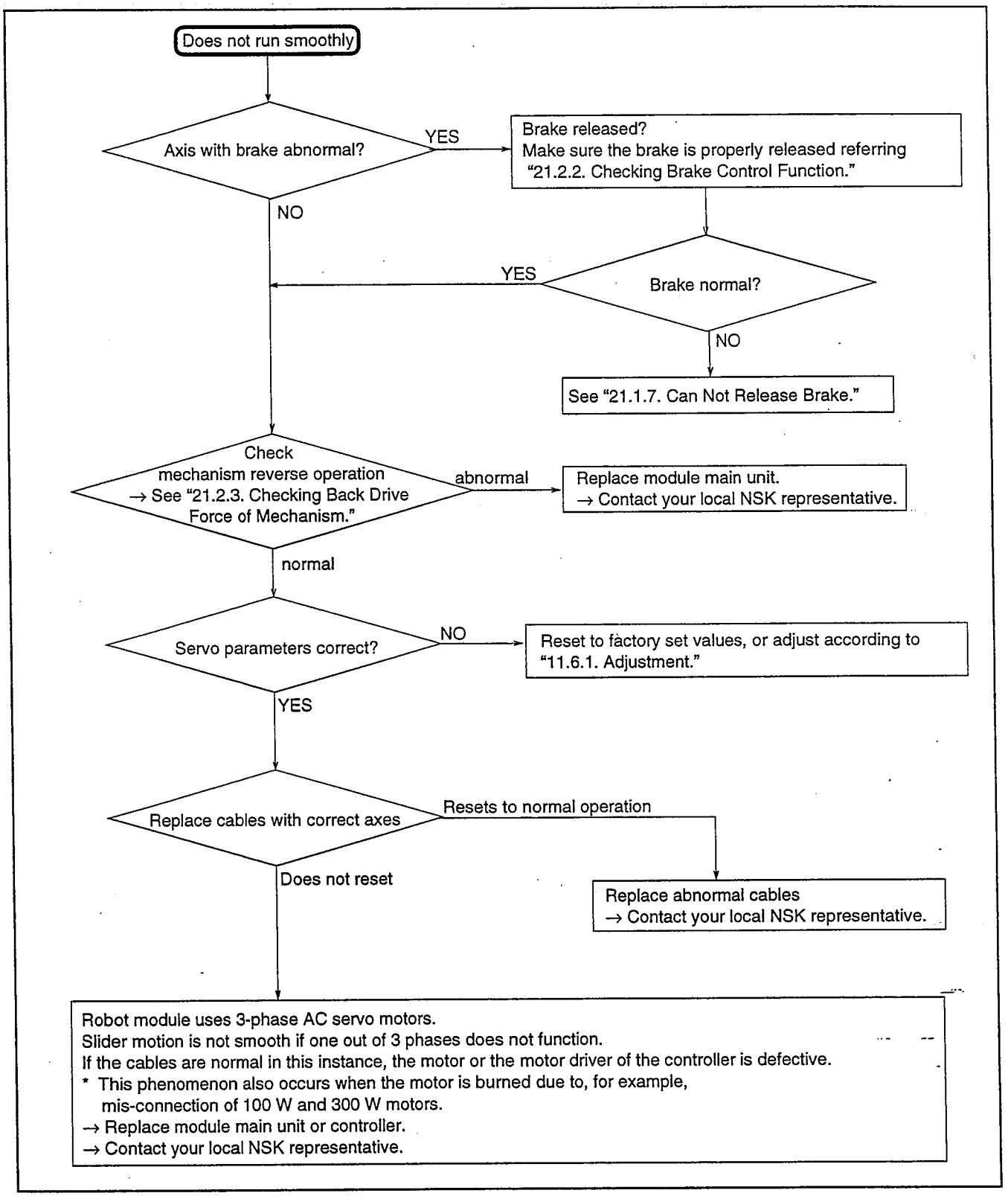



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.1.6. Does not Run Smoothly

★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-16*



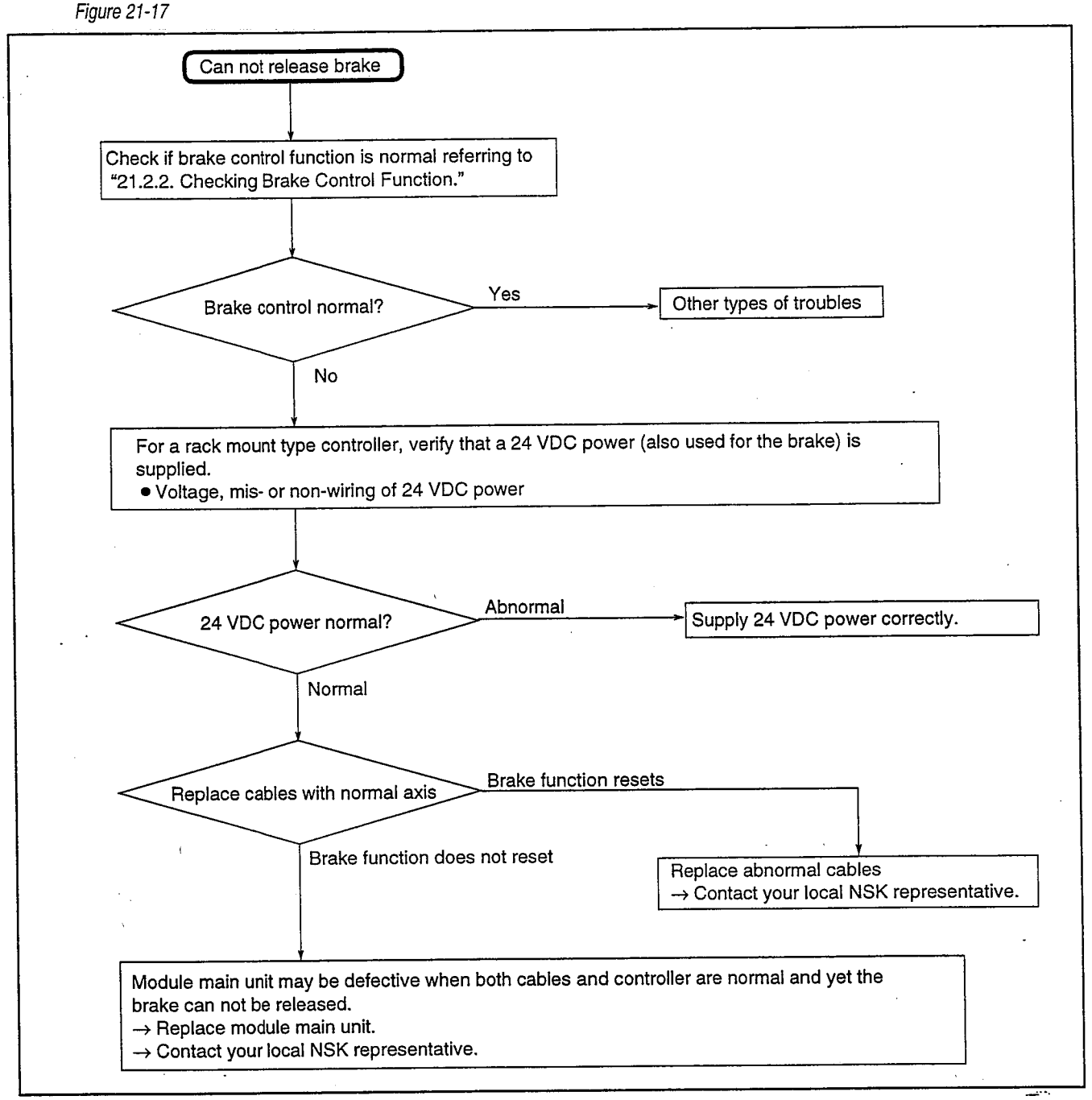



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.1.7. Can not Release Brake

★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-17*



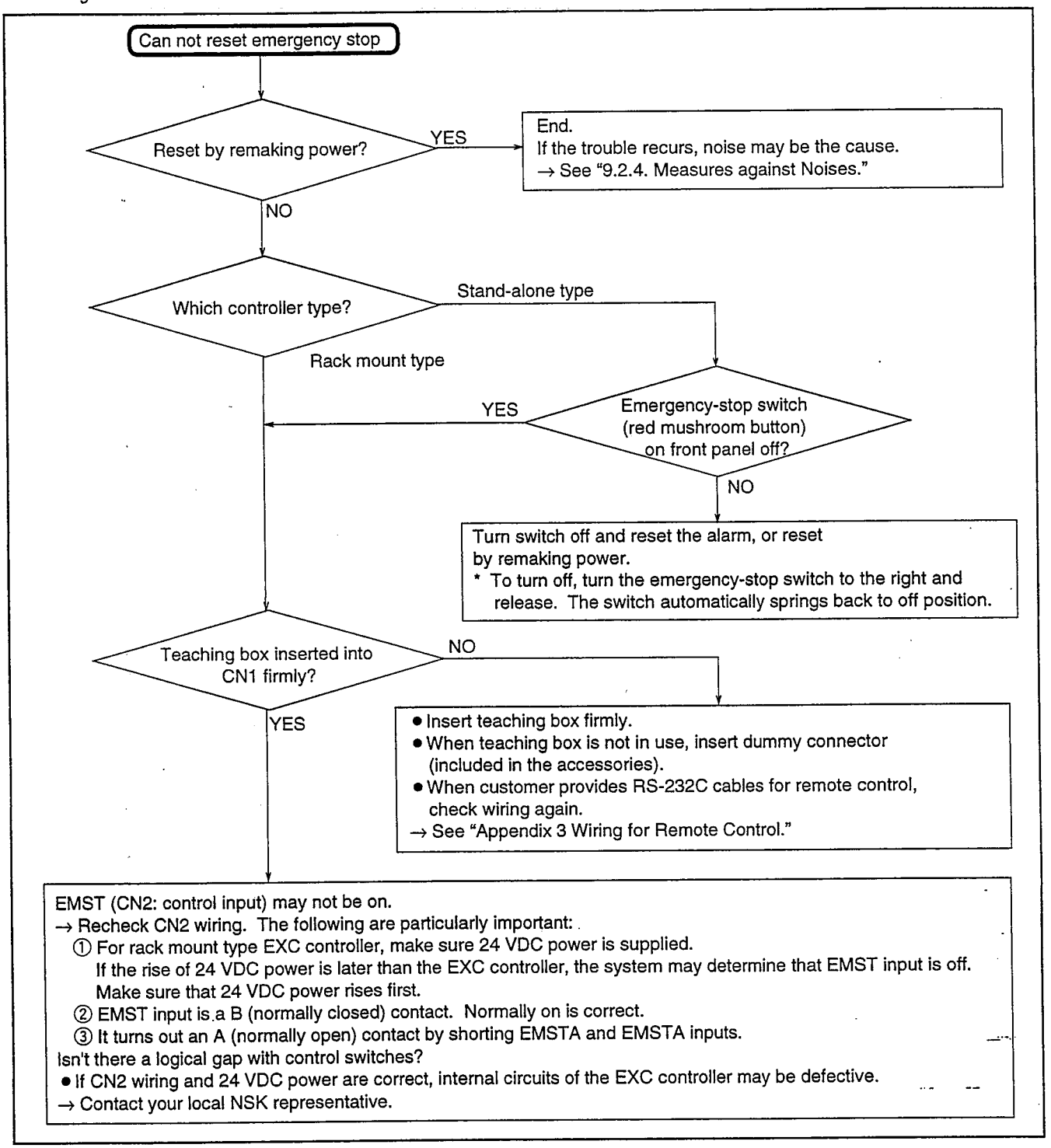



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.1.8. Unable to Reset Emergency Stop

★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-18*





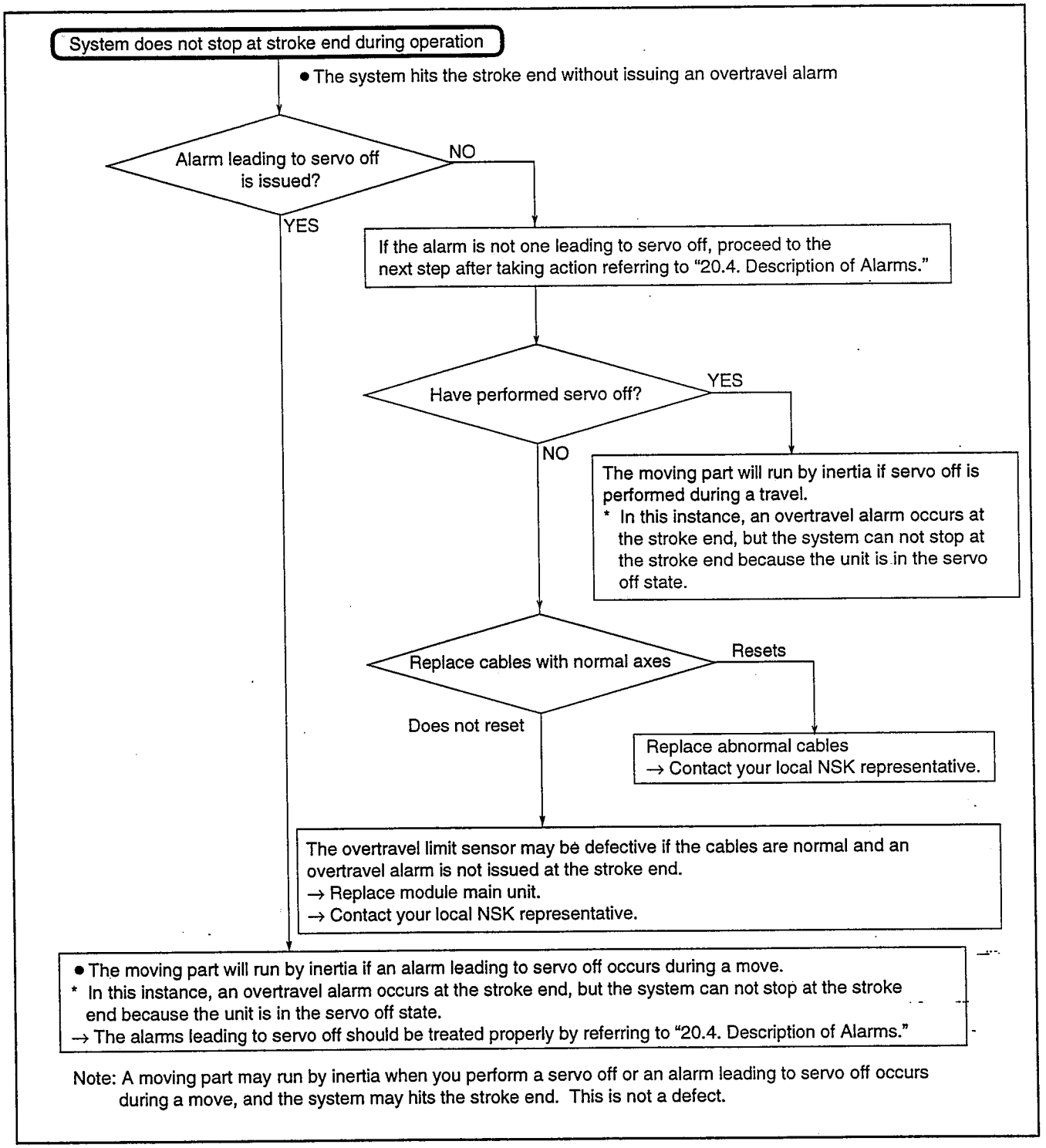

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.1.9. Overtravel Limit Abnormal

★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

★ If the system does not stop at the overtravel limit but hits the stroke end or work severely, check the damage to the module main unit referring to "21.2.5. Action for Runaway and Collisions."

*Figure 21-19*

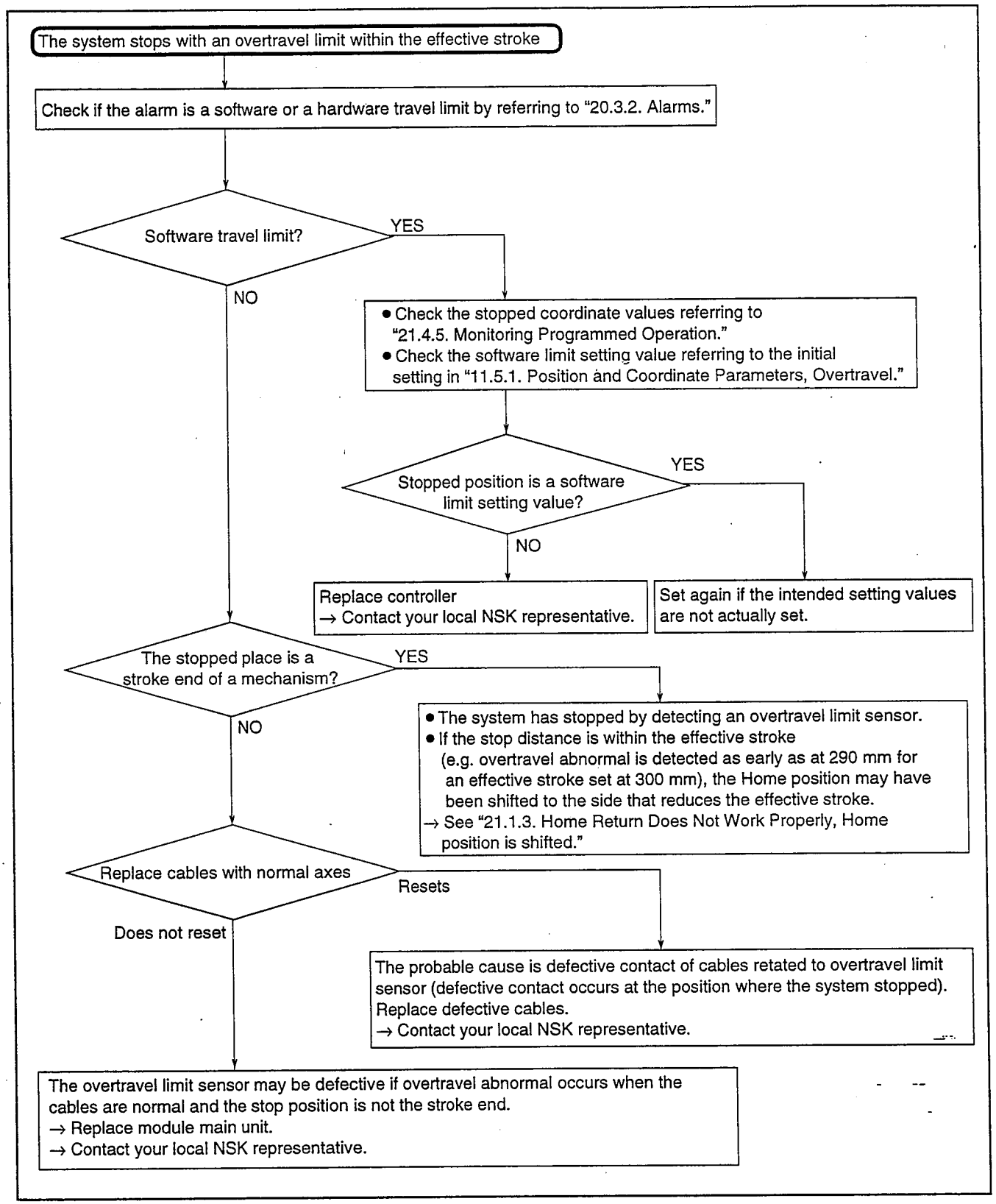



Note: A moving part may run by inertia when you perform a servo off or an alarm leading to servo off occurs during a move, and the system may hits the stroke end. This is not a defect.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-20*



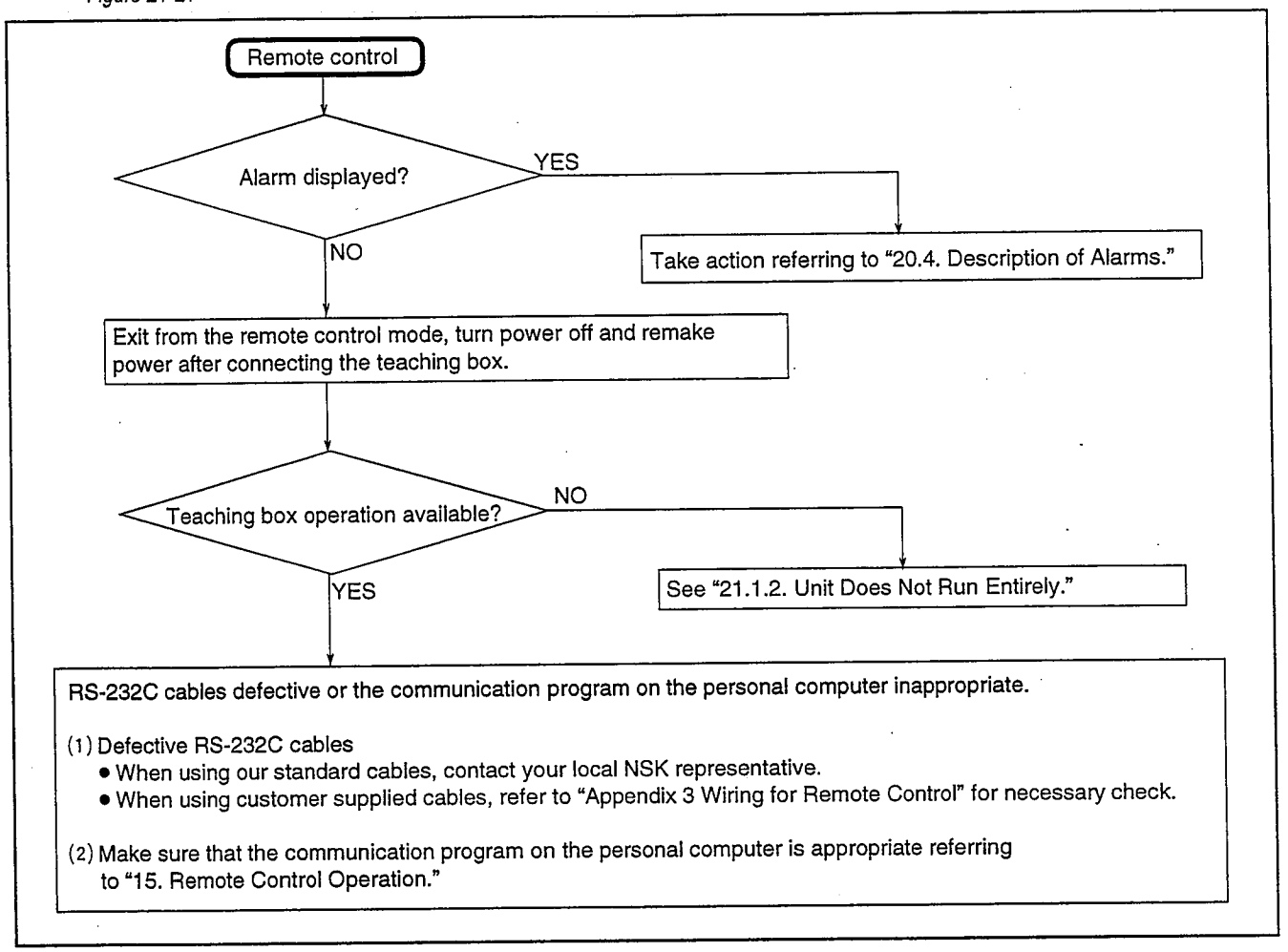



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.1.10. No Communication in Remote Control Mode

★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-21*



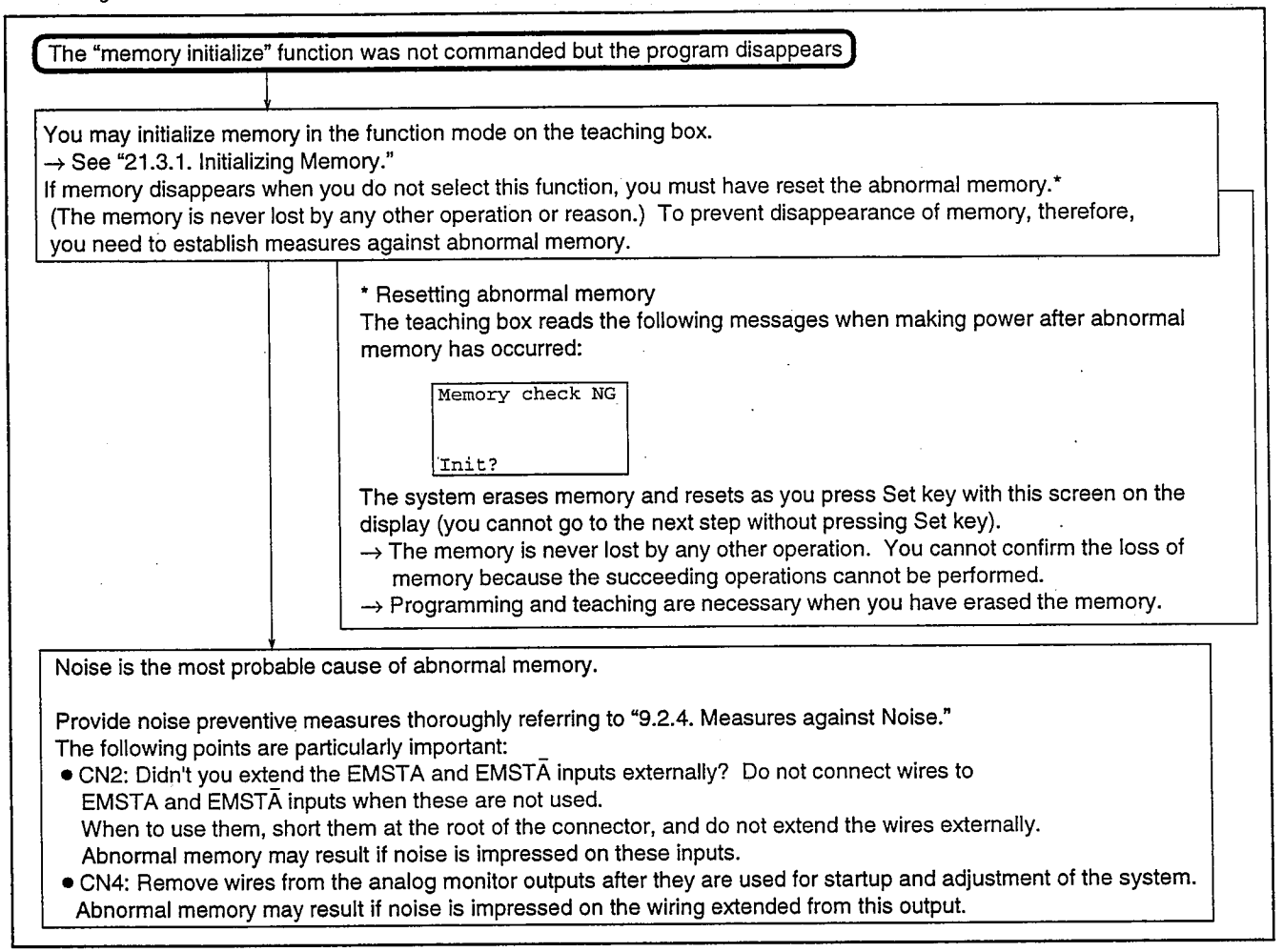


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.1.11. Program Disappears

★ Be sure to observe (Danger) and (Warning) instructions on pages 21-1 and 21-2.

*Figure 21-22*



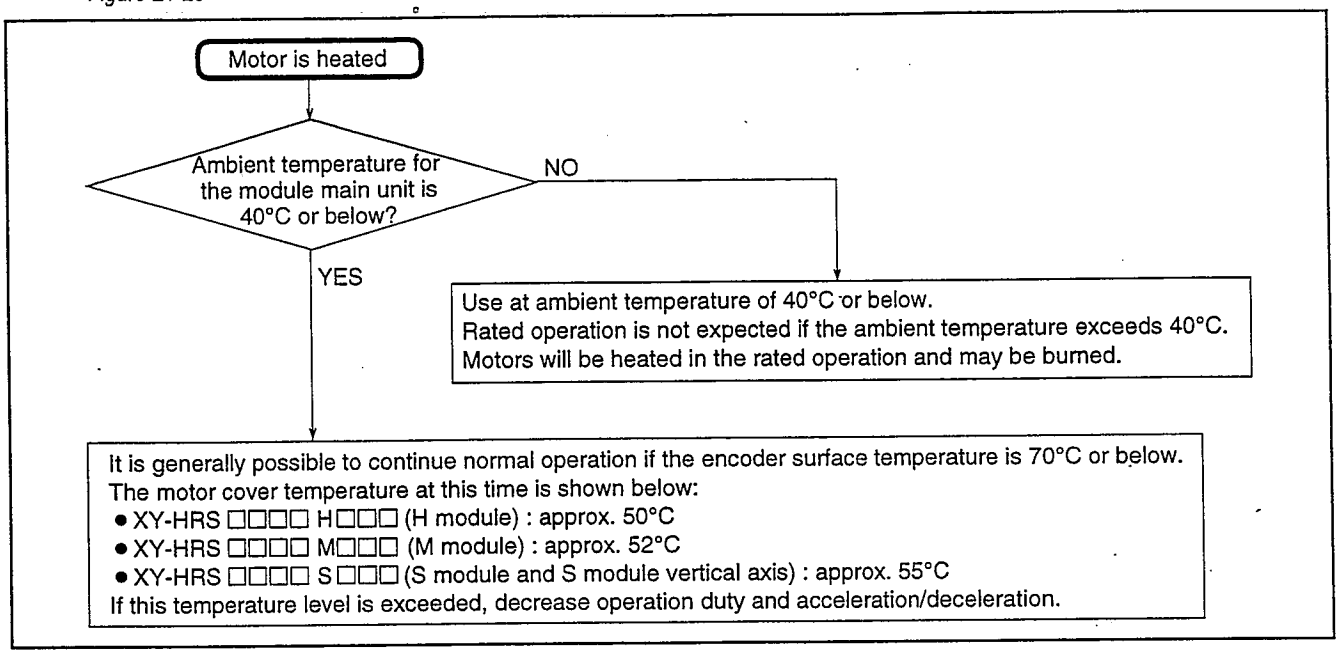



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.1.12. Gets Heated

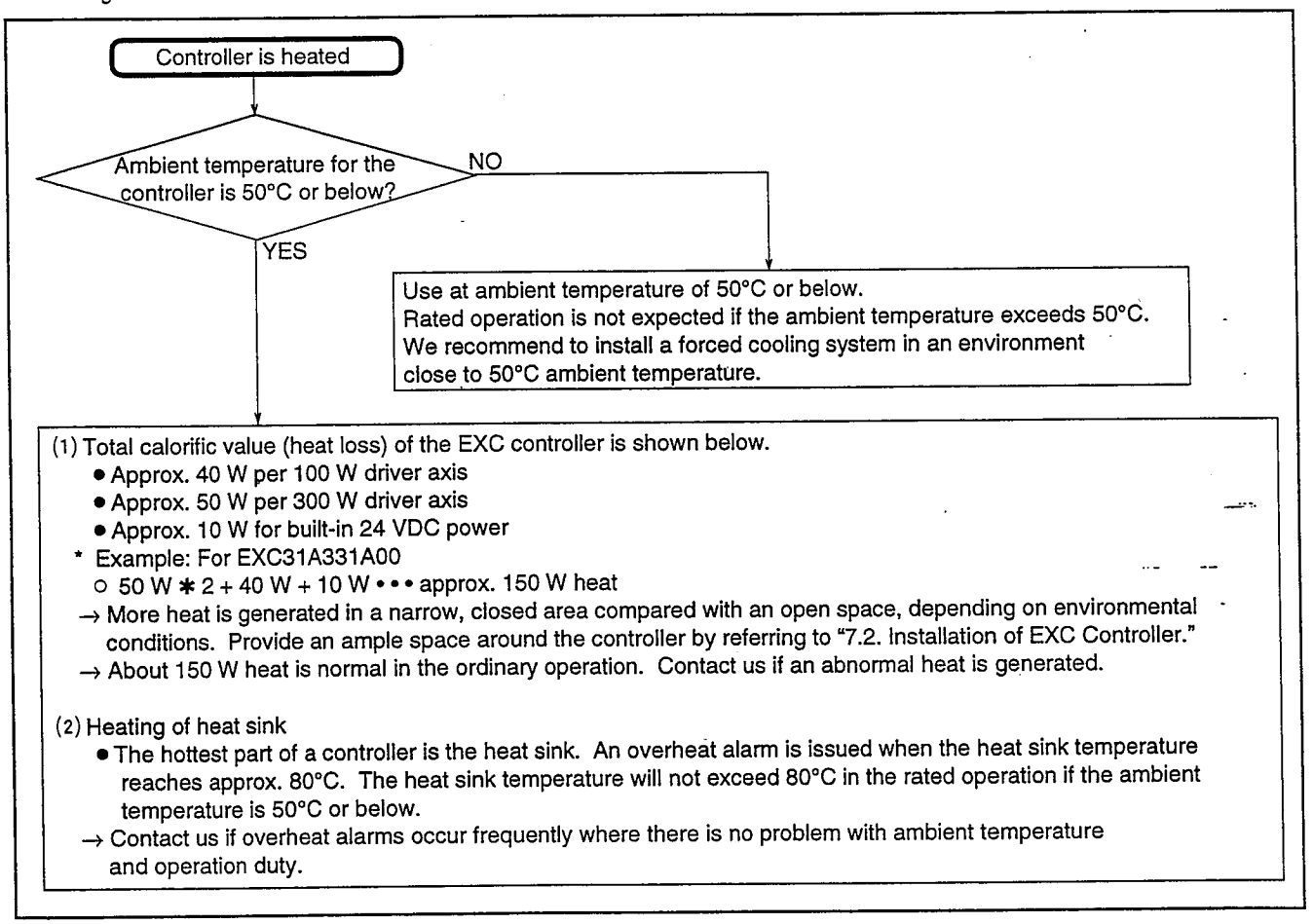
★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-23*




★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-24*



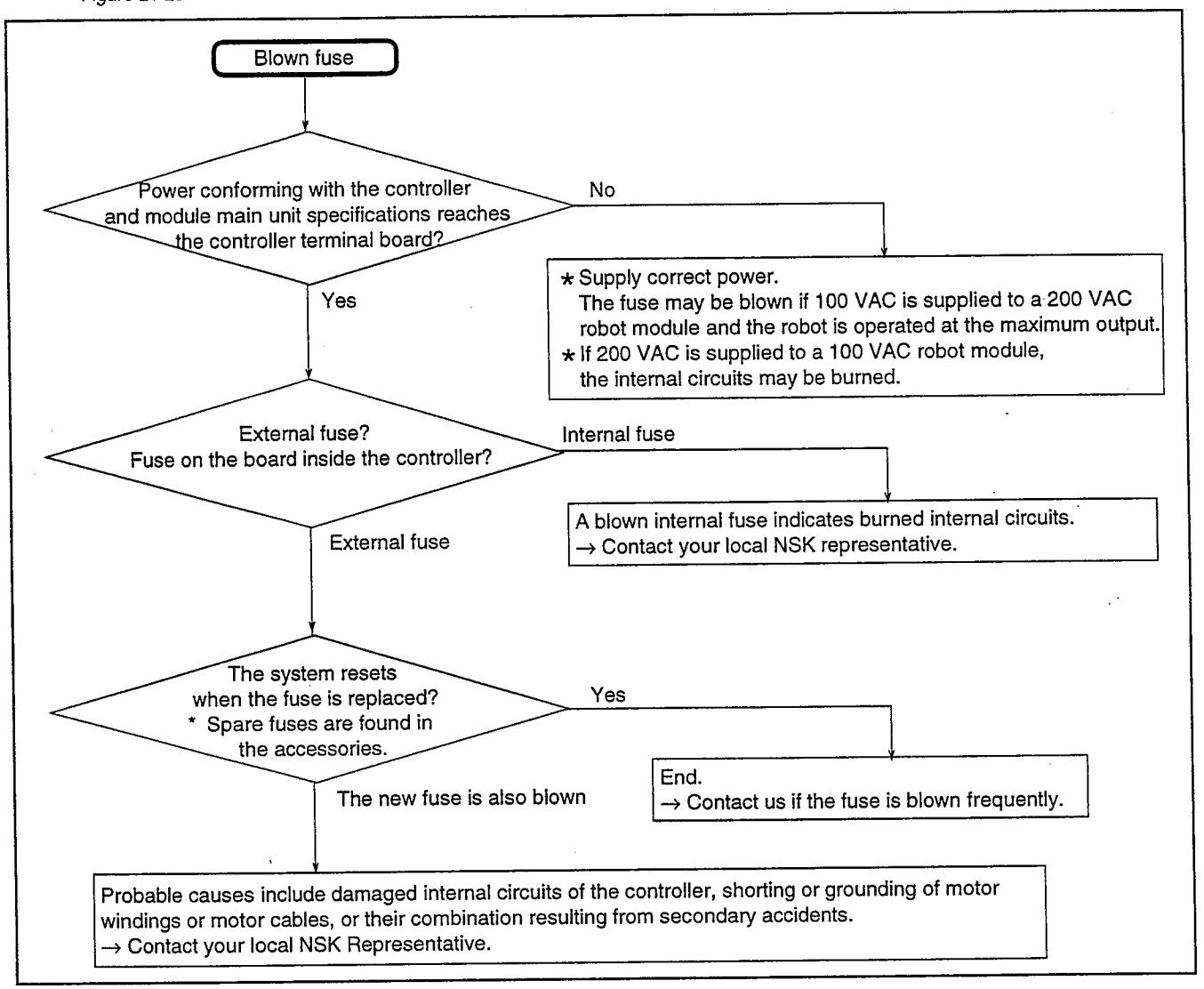


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.1.13. Blown Fuse

★ Be sure to observe Danger and Warning instructions on pages 21-1 and 21-2.

*Figure 21-25*






Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.2. Checking Procedures in Trouble Shooting

*Danger : Check the following before attempting trouble shooting. If these items are not observed, trouble shooting itself can be dangerous and further critical accident may occur due to secondary accidents such as motor burns and runaway.*

(1) Matching of module main unit and power amplifier.

Check that the motor output specifications for the module main unit conform with the driver output specifications for the controller, and the main power voltage of the main unit with that of the controller.

Example of error ①: X axis (300W axis) and Z axis (100w axis) are switched in connection.

Example of error ②: A 100V main unit is connected to a 200V controller.

(2) We recommend to use NSK's standard controller cables.

If you have provided the cables by yourself or modified the originals, check that there is no mis-wiring.

Example of error ①: System runaway may occur if U,V and W wires of the motor power line are wrongly connected.

Example of error ②: System runaway may occur if encoder signal lines are wrongly connected.

(3) Check that supply voltage is correct.

- EXC□□A□□□A□□ : AC180V~242V, single-phase
- EXC□□A□□□C□□ : AC90V~121V, single-phase

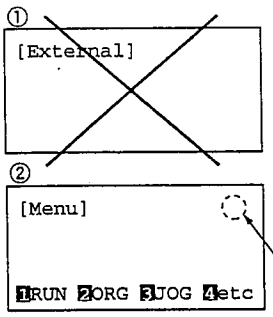
The driver unit may be burnt if the above voltage range is exceeded.

(4) Make sure that you did not erroneously connect the FG terminals and AC power lines. If the AC power is connected to the FG terminal, or to the ground, the controller may function improperly and burn out.

*Danger : (1) Before attempting trouble shooting, check that the moving parts of the module main unit have completely stopped.*

*(2) The following must be obersved when reaching or adjusting moving part while attempting trouble shooting.*

- Set the controller to the teaching mode operation and at the same time set it to the servo off state. This is necessary to prohibit external servo on operation and driving of the unit.




: Check that the system mode selected is not the external operation mode.
Do not enter the area bound by the safety fences if the monitor shows display ①.

: Check that the servo on mark (*) on the upper right corner of the display is turned off.

Servo off display

- When you must perform servo on operation or operate the system while checking for an avoidable reason, make sure that no person and equipment that might be damaged are present in the robot working area. Also provide necessary means to prevent entry of other persons into the area while you are working.
- Keep the teaching box near the checker ready for immediate use in case of need.
- Before starting the work, test that the emergency stop state occurs as it should when you press the emergency stop key on the teaching box ( that is, you should start working after making sure that the emergency stop function will work properly).

*(3) When releasing the brake of a vertical axis, move the slider to the lower stroke end by jog operation to prevent injury of person and damage to unit.*



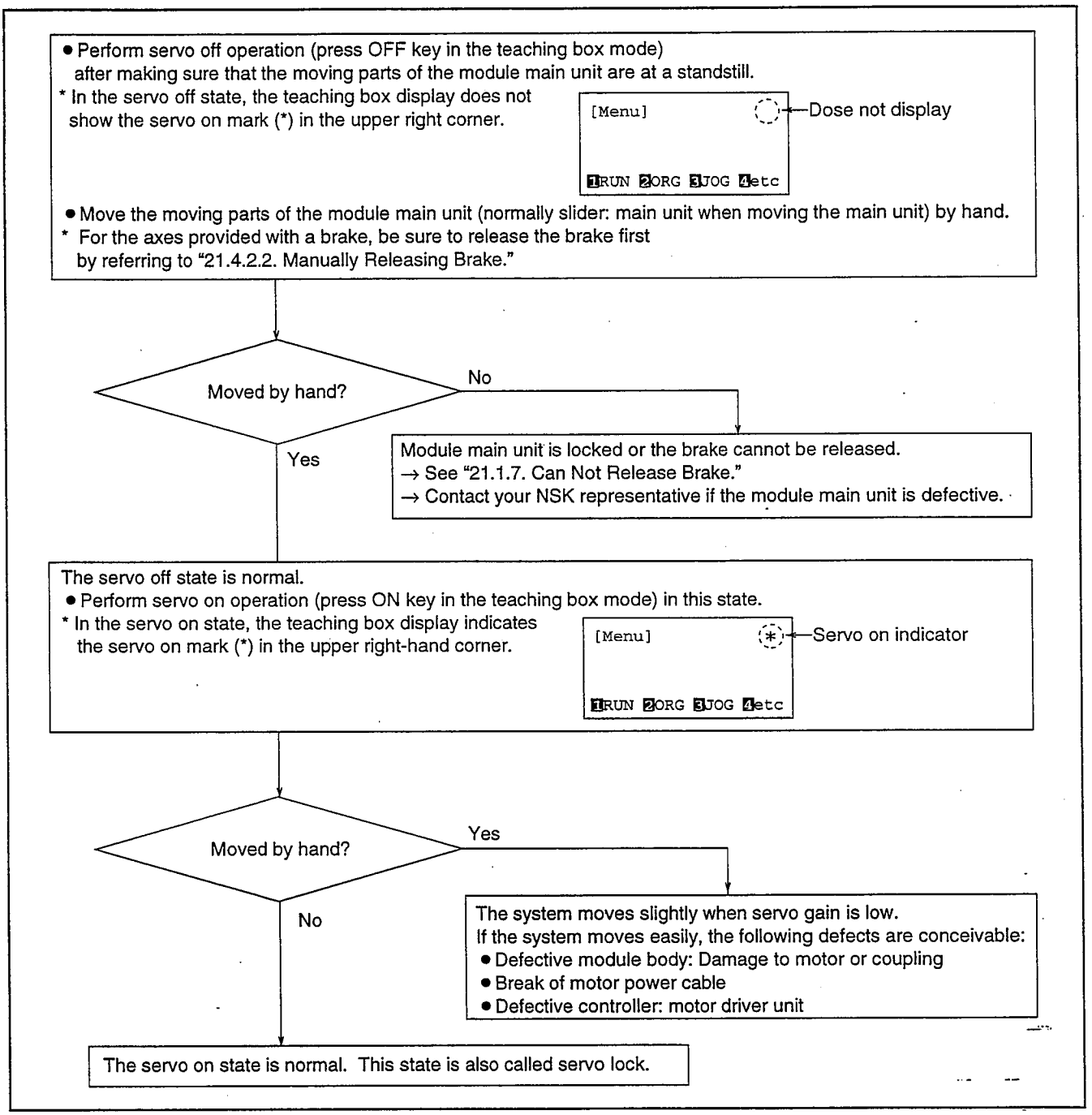
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.2.1. Checking Servo Lock State

★ Be sure to observe (Danger) instructions on pages 21-25.

★ Before following the steps below, reset any existent alarm by referring to "20.4. Description of Alarms."

*Figure 21-26*





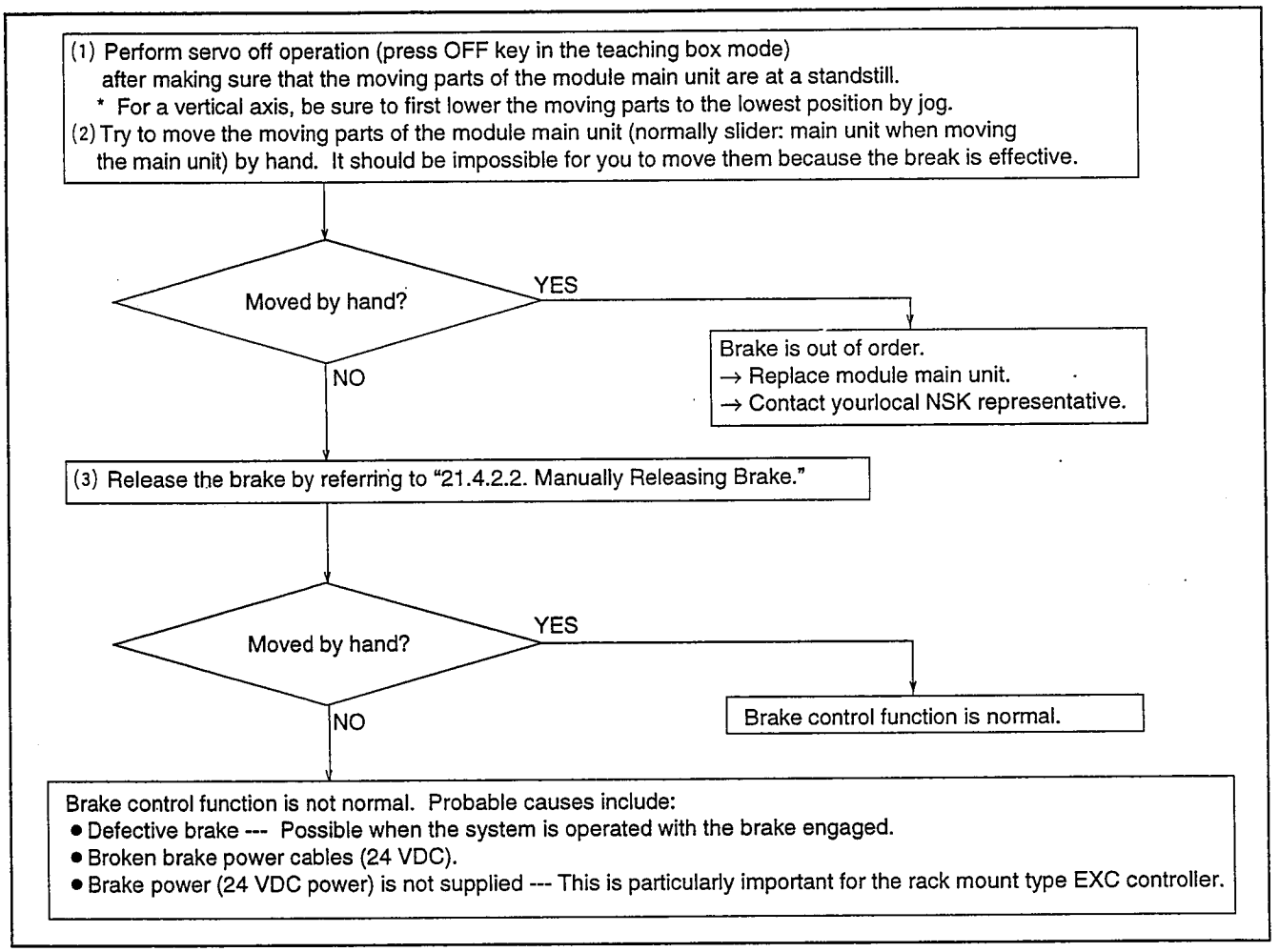

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.2.2. Checking Brake Control Function

★ Be sure to observe Danger instructions on pages 21-25.

★ Before following the steps below, reset any existent alarm by referring to "20.4. Description of Alarms."

*Figure 21-27*





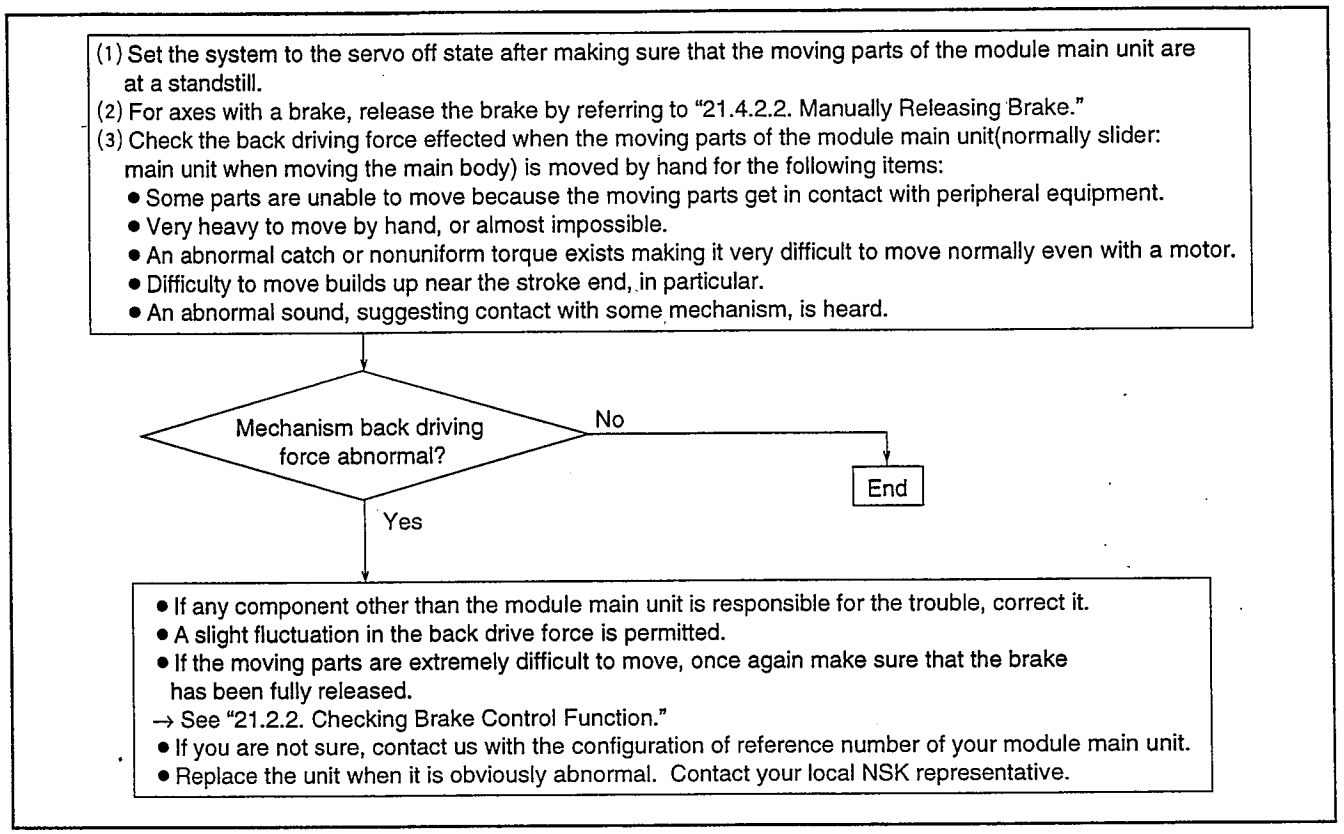

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.2.3. Checking Back Drive Force of Mechanism

★ Be sure to observe Danger instructions on pages 21-25.

★ Before following the steps below, reset any existent alarm by referring to "20.4. Description of Alarms."

*Figure 21-28*





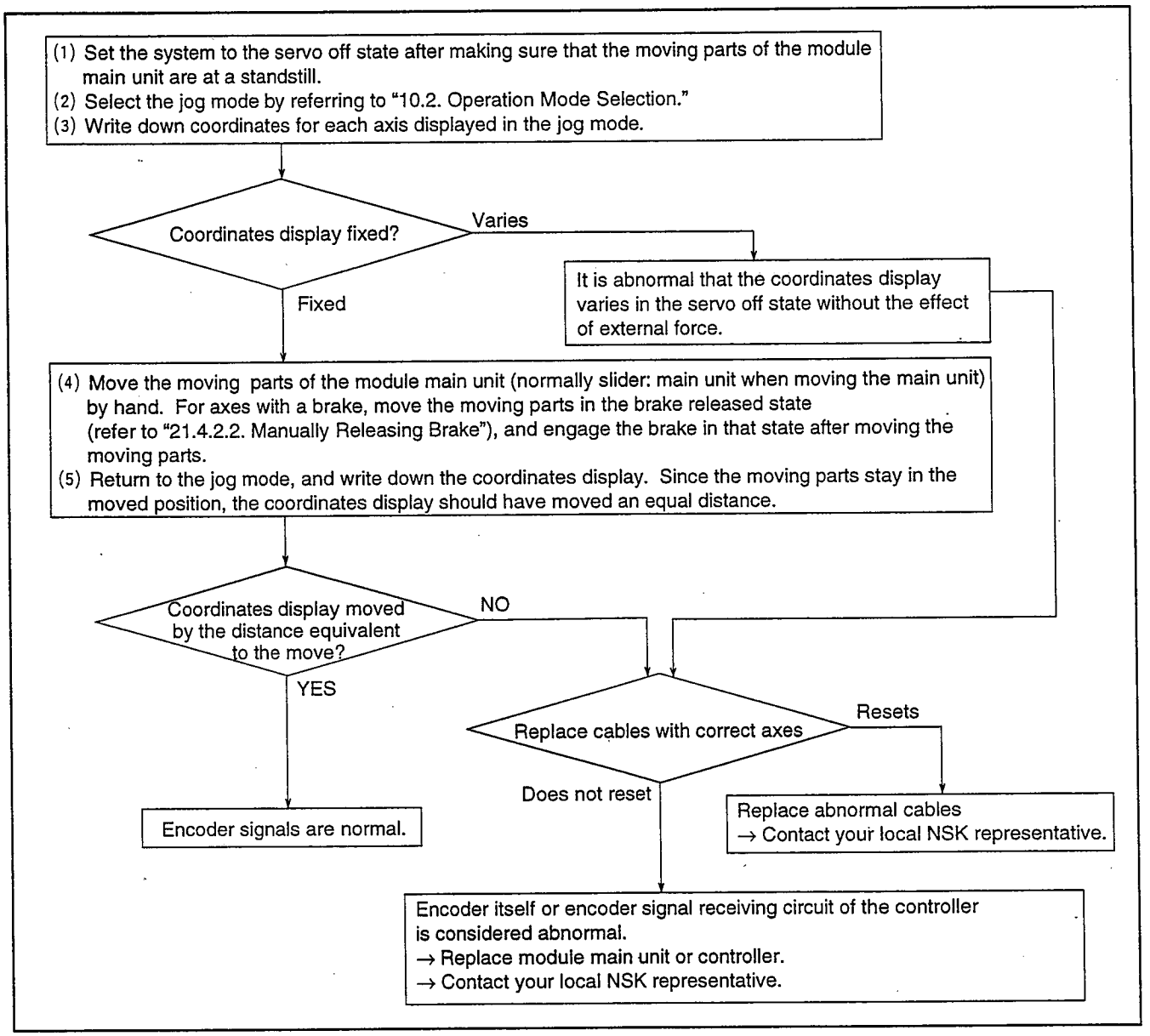

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.2.4. Determining Defective Encoder Signal.

★ Be sure to observe Danger instructions on pages 21-25.

★ Before following the steps below, reset any existent alarm by referring to "20.4. Description of Alarms."

*Figure 21-29*






Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

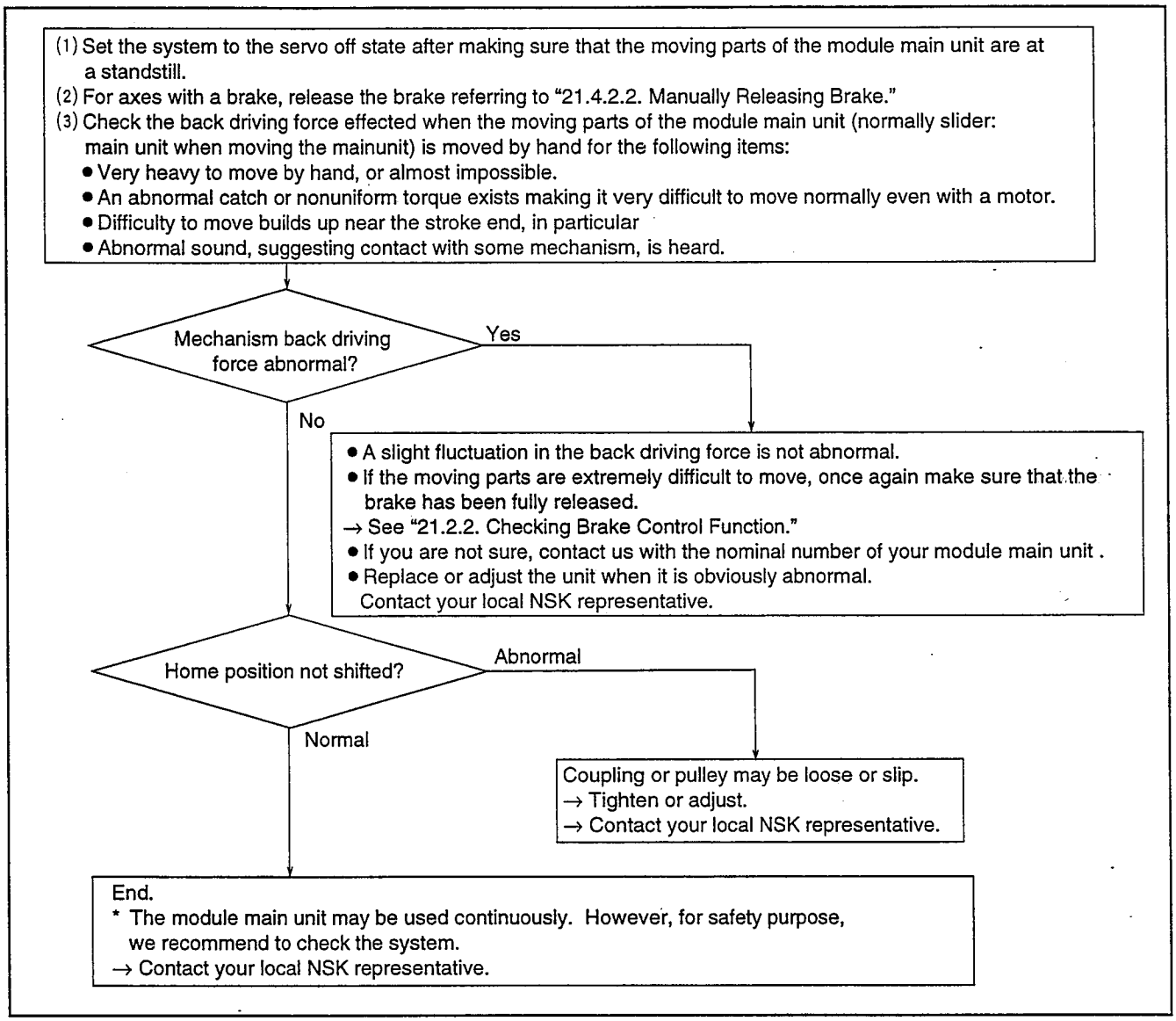
## 21.2.5. Action for Runaway and Collisions

- Check the system according to the procedure in Figure 21-30 when a severe crash occurred at the stroke end.

★ Be sure to observe (Danger) instructions on pages 21-25.

★ Before following the steps below, reset any existent alarm by referring to "20.4. Description of Alarms."

*Figure 21-30*






Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.3. Confirming Memory Initialize and Software Version

### 21.3.1. Initializing Memory

- When memory initialize is executed, back up memory in the RAM is erased. All parameters are initialized and the program contents will be lost.

- The memory area is divided into two. The areas are selectively erased.

*Table 21-1*

| Memory area | Memory contents | State after initializing |
|---|---|---|
| Program | Programs as well as coordinate data acquired by teaching | Erased |
| Parameter | Initially set parameters | Initialized<br>● Software thermal parameter will be a 100 W equivalent value.<br>● All other parameters are reset to factory set values. |

*Danger : When you select Parameter Initialize, all parameters are reset to the factory set values (excluding software thermal). After initializing, check to be sure that all the parameters have been set as intended. If any parameter(s) is set differently, the system may move unexpectedly. When you approach the module main unit for troubleshooting, for example, check that the movable range has not been changed.*

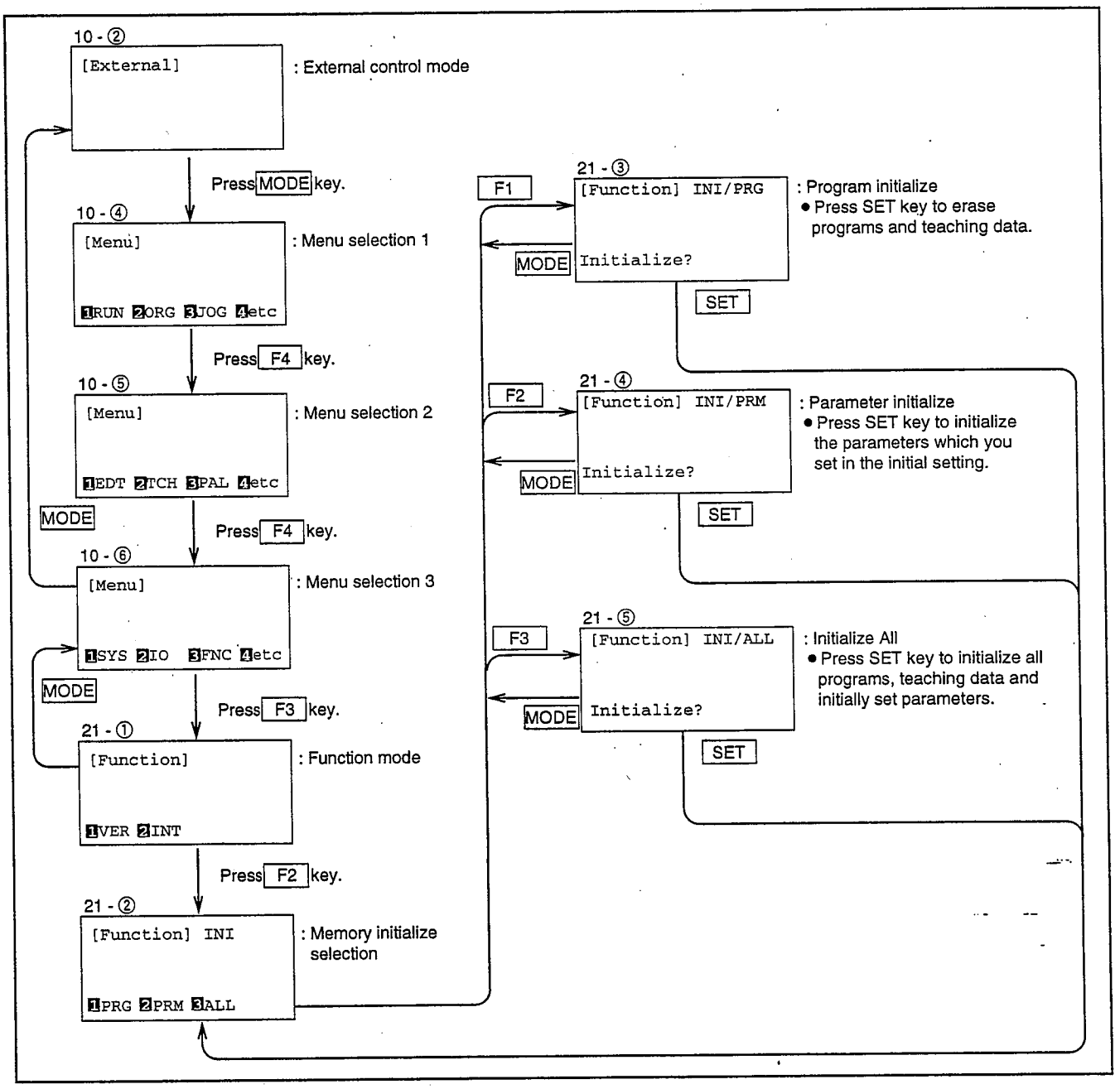
*Caution : By selecting Program Initialize, programs and teaching contents are erased. Program operation may not be performed unless you program and teach again.*


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## ● Memory Initialize Procedure

- Select the function mode referring to "10.2. Control Mode Selection."
- Press F2 key in the function mode to get the memory initialize select display.
- Specify the area to be initialized by pressing F1 through F3 keys on the memory initialize select display.
- Press Set key in each initialize display to initialize the selected memory area. Return to the initialize select display.
- When you press Mode key in each initialize display, you return to the memory initialize select display without initializing.

*Figure 21-31*






Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

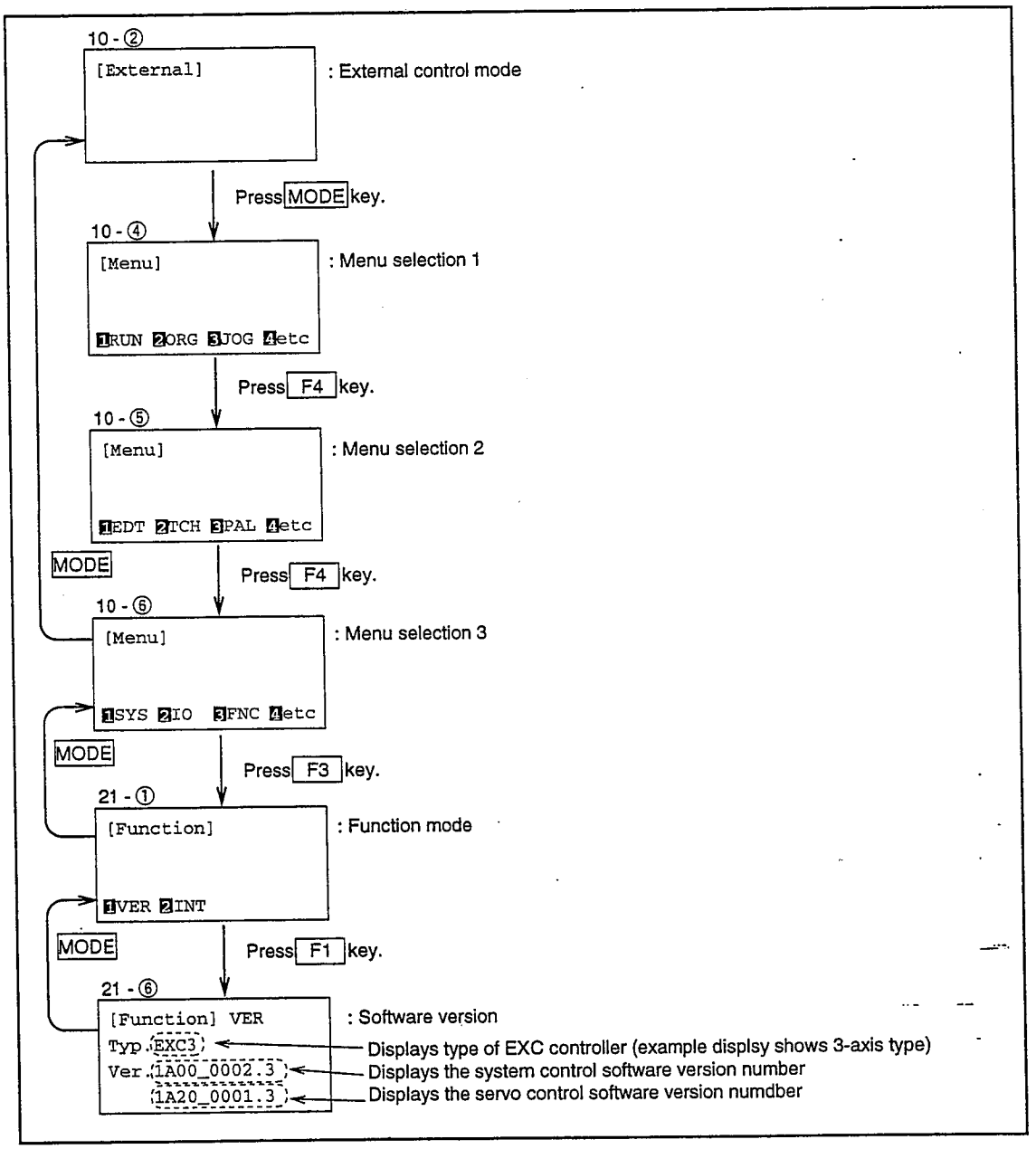
## 21.3.2. Checking Software Version

- You may check the software version of your EXC controller.

### ● Procedure to Check Software Version

- Select the function mode referring to "10.2. Control Mode Selection."
- Press F1 key in the function mode to get the software version display. The controller type and software version are shown.
- The display returns to the previous screen as you press Mode key.

*Figure 21-32*






Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.4. Monitor Function

- EXC controller has the following monitor functions.
  - ① Analog output ---------- Monitor velocity through CN4 analog monitor output.
  - ② Control I/O ---------- Monitor CN2 control I/O and brake output. Only control output can be set to ON/OFF through the teaching box in the control I/O monitoring mode.
  - ③ General I/O ---------- Monitor CN4 and CN7 general I/O state. Only general output can be set to ON/OFF through the teaching box in the general I/O monitoring mode.
  - ④ Limit sensor ---------- Monitor input state of over travel limit sensor.
  - ⑤ Programmed operation ----- Monitor present position and executing program command in the programmed operation mode.

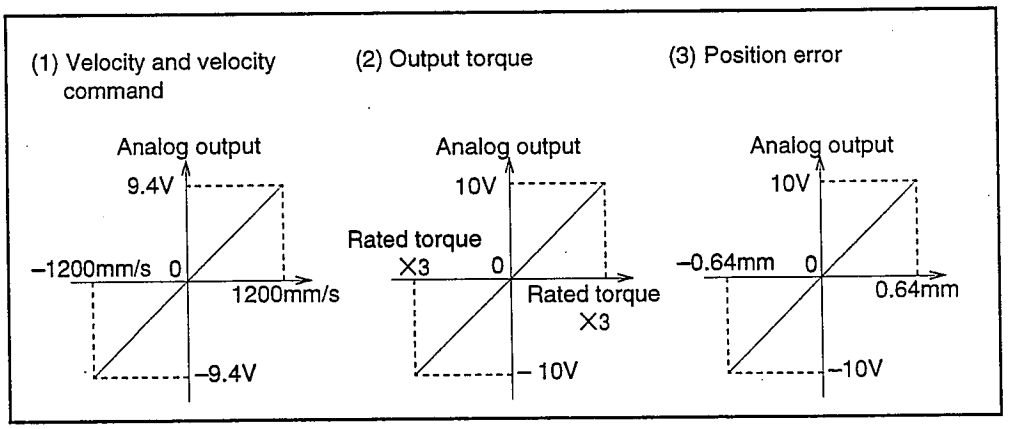
### 21.4.1. Analog Monitor

- The following of each axis can be monitored by analog voltage through CN4 analog monitor output.
  - ○ Velocity: Actual velocity
  - ○ Velocity command
  - ○ Output torque: Current command to the motor
  - ○ Position error: Difference between present position and position command.

Caution : *Use the analog monitor function when starting up and adjusting the system. After adjusting, the wires of the CN4 analog monitor output should be removed from the root of the connector. If you leave them extended, external noises and other factors may affect the operation of the EXC controller or cause memory failure.*

**● Output specification**

*Figure 21-33*



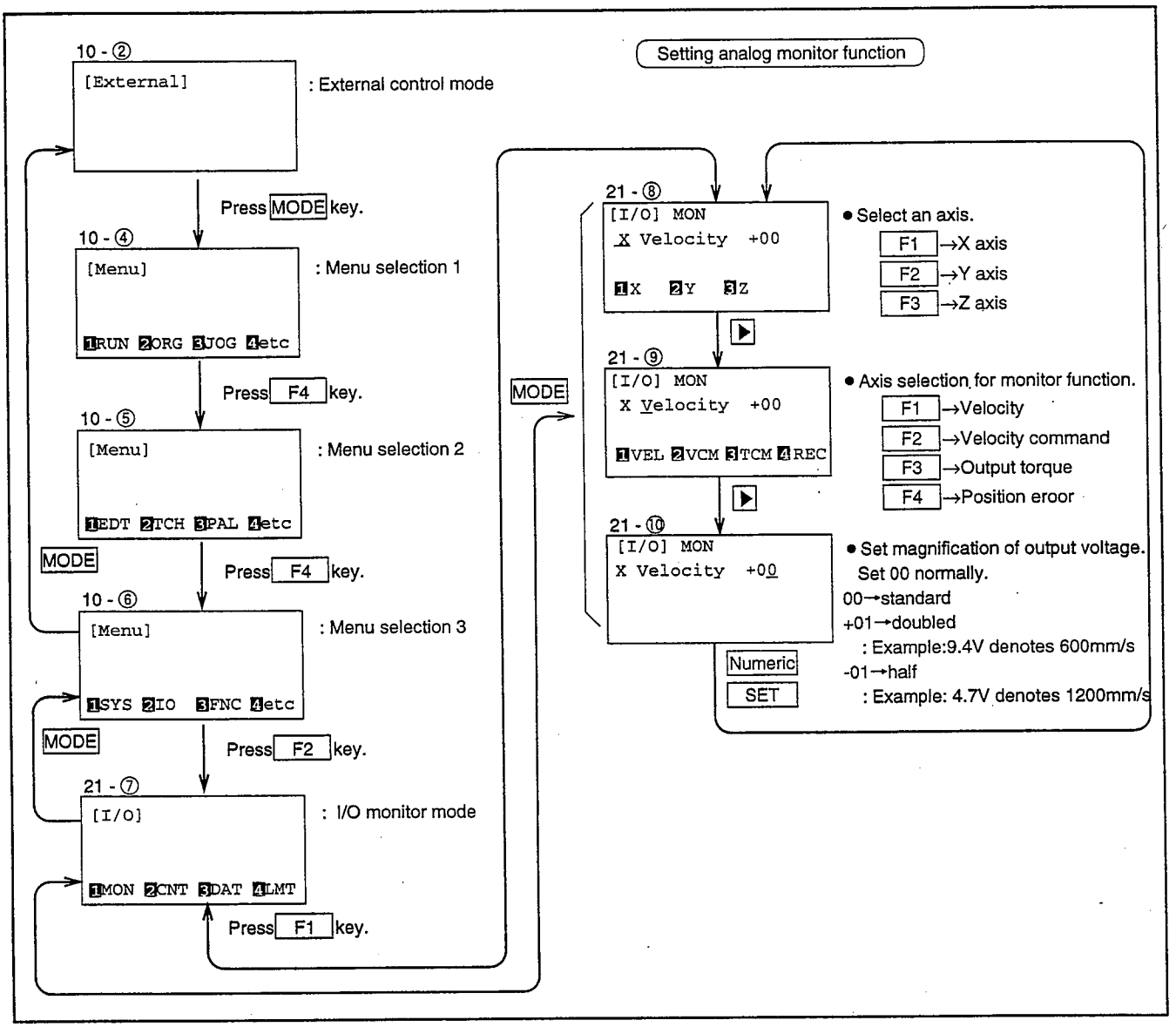

* Output voltage may vary in +/- 5%.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## ● Setting procedures of analog monitor function

- Follow the procedures below to select monitoring function.
- Set the screen to I/O monitor mode reffering to "10.2. Control Mode Selection."
- Press F1 key in I/O monitor mode. Analog monitor function may be set.

*Figure 21-34*






Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 21.4.2. Control I/O Monitor and Releasing Brake

### 21.4.2.1. Control I/O Monitor

- Monitors state of ON/OFF of CN2 control input in real time.
- Switch the state of CN2 control output.*
- Use monitor function when system start up, adjusting system and chcking wiring.

* Switching control output state

○ This function may be used to check the CN2 output wiring. Only the state of output may be switched without changing internal setting of EXC controller in this monitoring mode.

Example : Alarm output siganl may be set to open while EXC controller does not carry out an alarm processing.

### 21.4.2.2. Manually Releasing Brake

- The brake output can be manually turned on and off while monitoring the control output. See "21.4.2.3. Procedures of Monitoring Control I/O and Brake Releasing".
- By manually releasing the brake of an axis, you can:
  ① Check if the brake control function is operating normally,
  ② Check the mechanism back drive operation by releasing the brake (→ "21.2.3. Chcking Force of Mechanism").
  ③ Determine a defective encoder by releasing the brake (→ "21.2.4. Determining Abnormal Encoder Signals").

Danger : *To release the brake, follow the procedure after confirming the safety of the environment.*

○ For a horizontal axis, the slider (main unit when the main unit is to be moved) must be at a standstill.

○ For a vertical axis, the movable part will fall. Make sure that no person or items that can be damaged are present below the movable part.

Take necessary action to prevent damage to the movable part when it falls.

Example: Lower the movable part to the lowest position usin jog operation before starting the work so that there would be no danger, or damage to equipment when the brake is released.

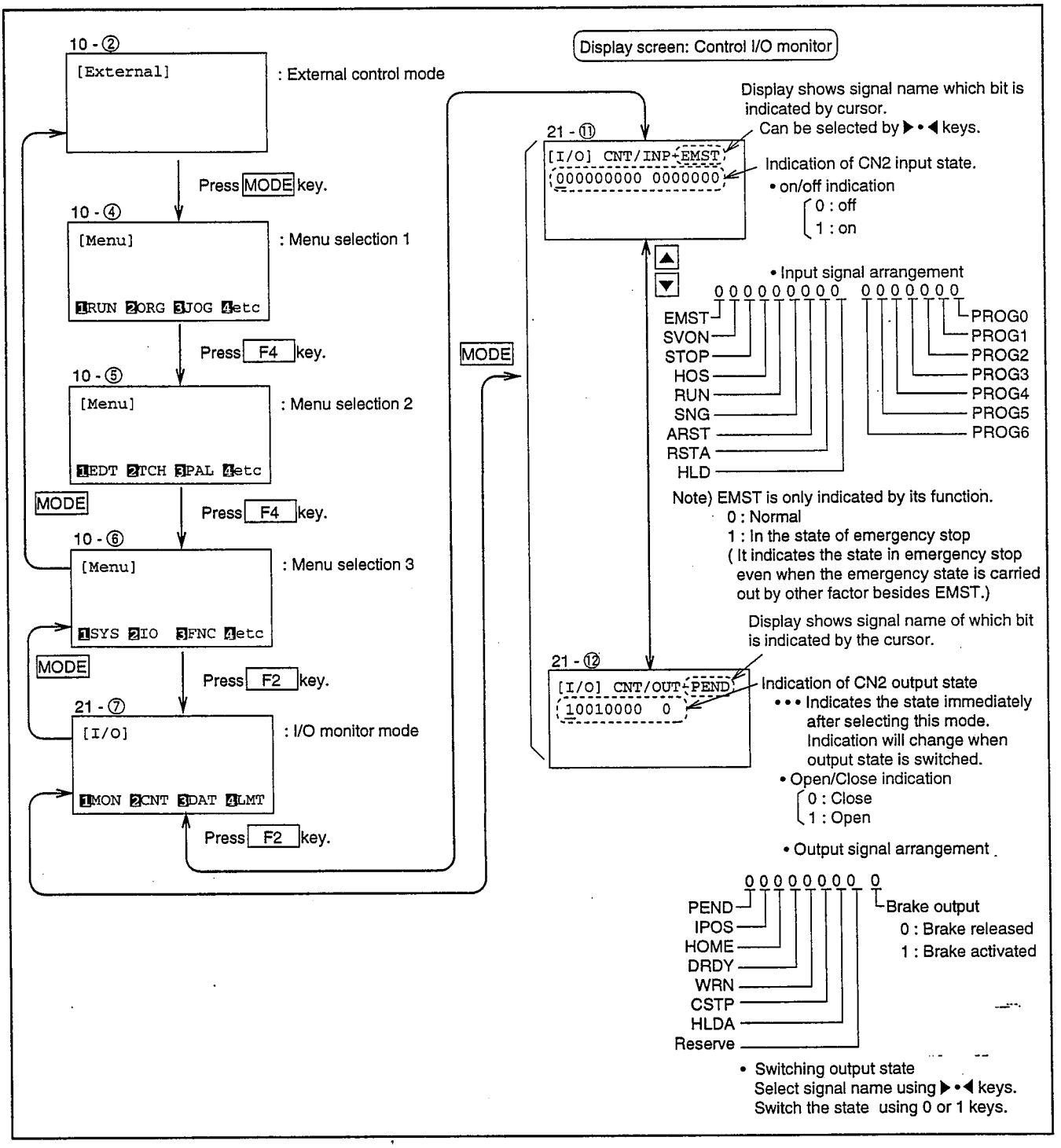


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

### 21.4.2.3. Procedures of Monitoring Control I/O and Releasing Brake

- Select the I/O monitor mode screen referring to "10.2. Control Mode selection."
- Press F1 key in the I/O monitor mode screen. You may turn on and off the control I/O monitor and brake.

*Figure 21-35*






Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

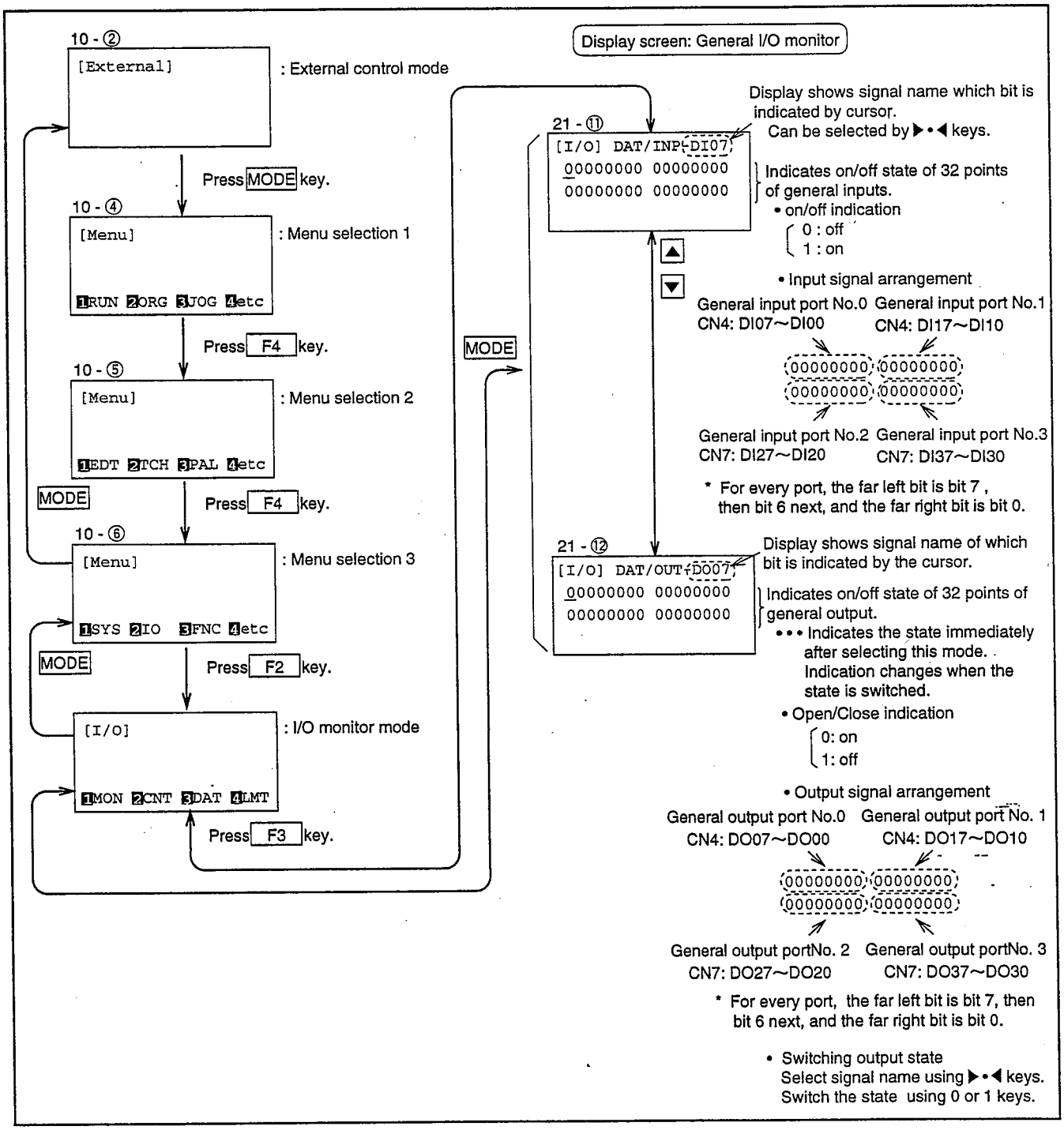
## 21.4.3. General I/O Monitor

- Monitor CN4 and CN7 input state in real time.
- Switch CN4 and CN7 input state.
- You may use the monitor when setting up and adjusting system and checking wiring.

### ● General I/O monitoring procedures

- Set to I/O monitor mode referring "10.2. Operation Mode Selection."
- Press F3 key in the I/O monitor mode screen. You may monitor general I/O state.

*Figure 21-36*






Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

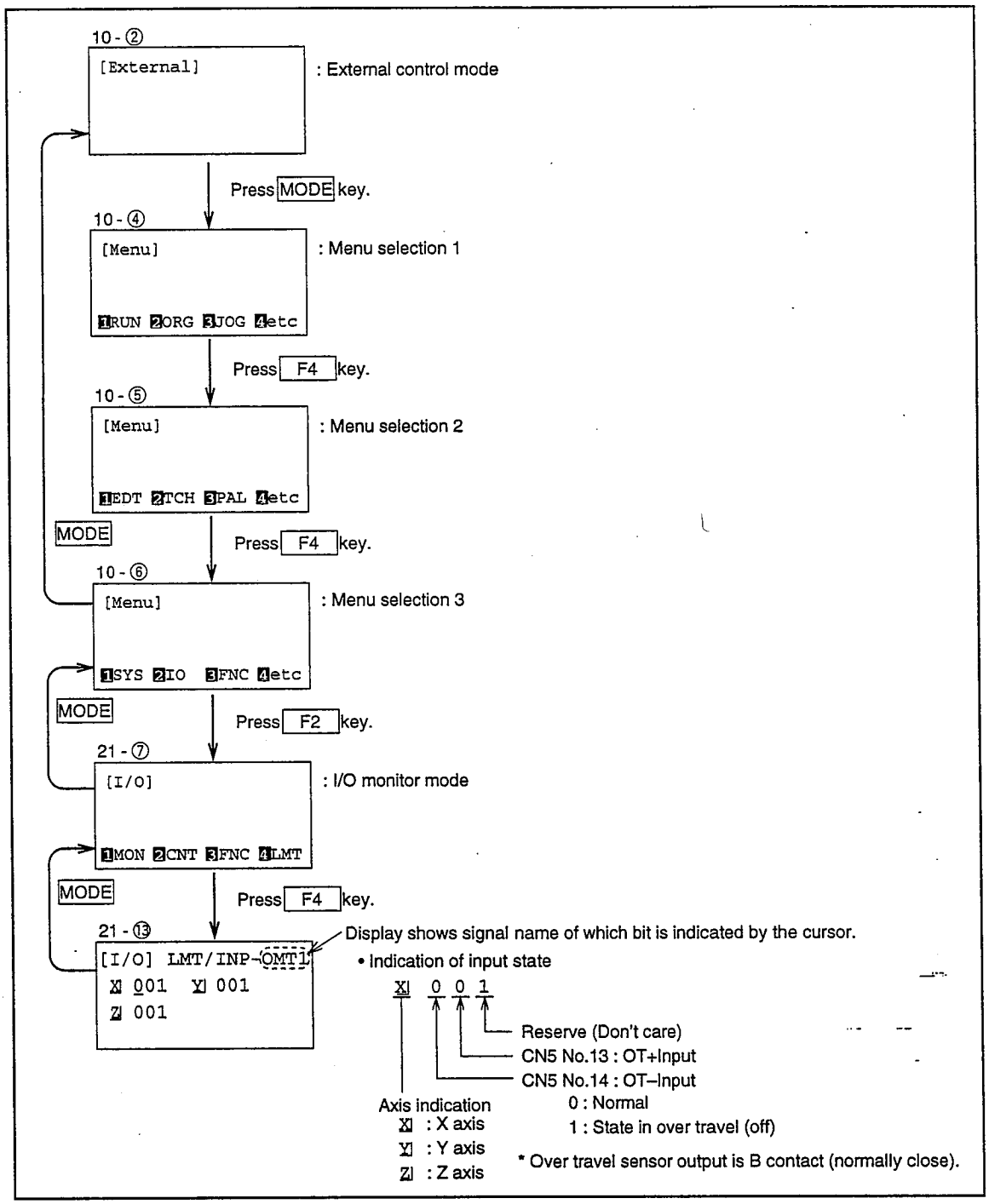
## 21.4.4. Limit Sensor Input Monitor

- State of CN5 over travel limit sensor can be monitored in real time.

### ● Monitoring procedures of limit sensor input

- Select I/O monitor mode referring "10.2. Operation Mode Selection."
- Press F4 key in I/O monitor mode screen. You may monitor the state of limit sensor input.

*Figure 21-37*





Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

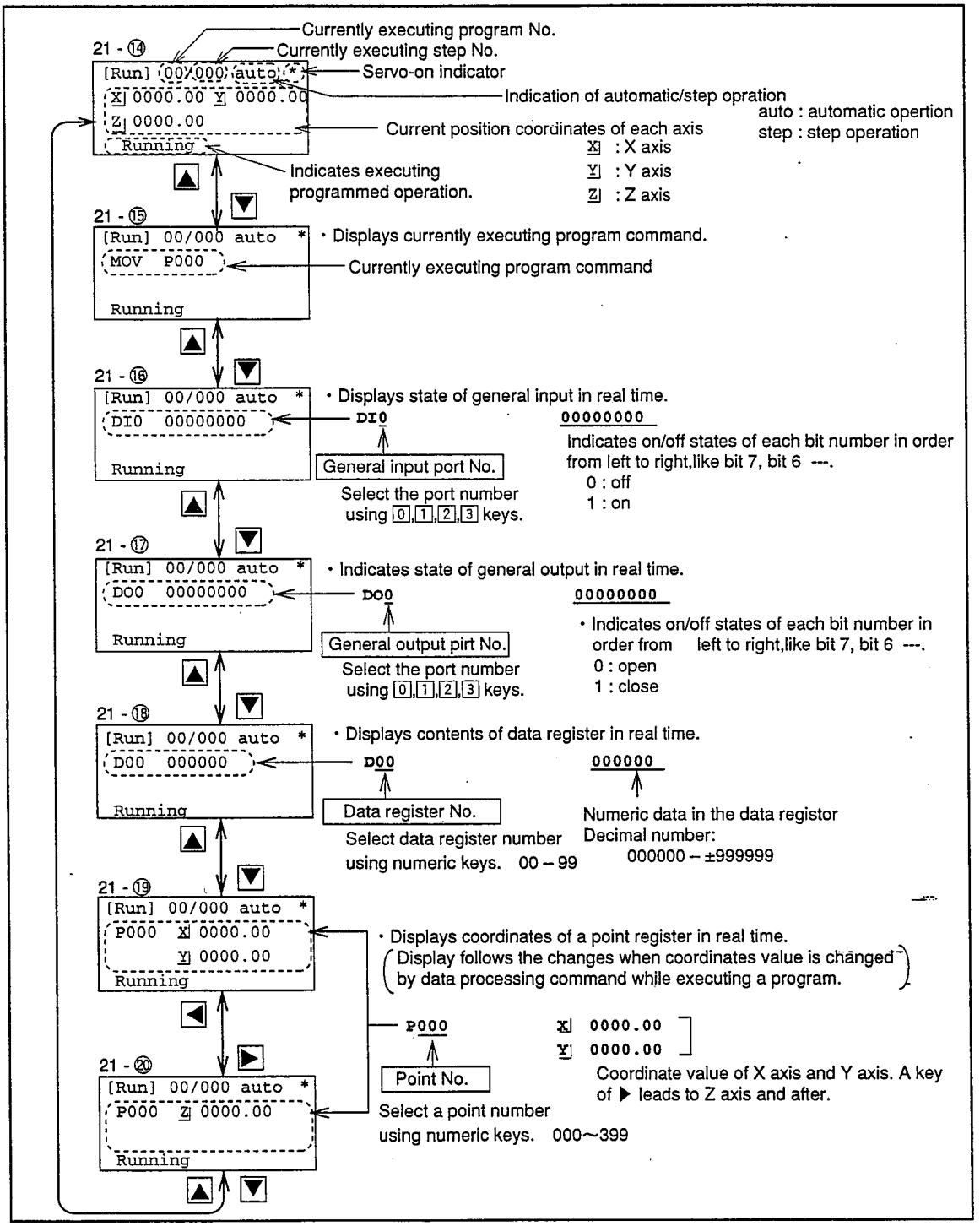
## 21.4.5. Monitoring Programmed Operation

### 21.4.5.1. Monitoring Function of Programmed Operation in Teaching Box Control Mode

- Current position of each axis can be monitored in real time when executing programmed operation in teaching box control mode.
- Monitor screen of executing program command and general I/O state can be selected by pressing ▲ ▼ keys in the display screen showing current position coordinates.

**● Monitoring programmed operation procedures in teaching box control mode**

*Figure 21-38*






Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

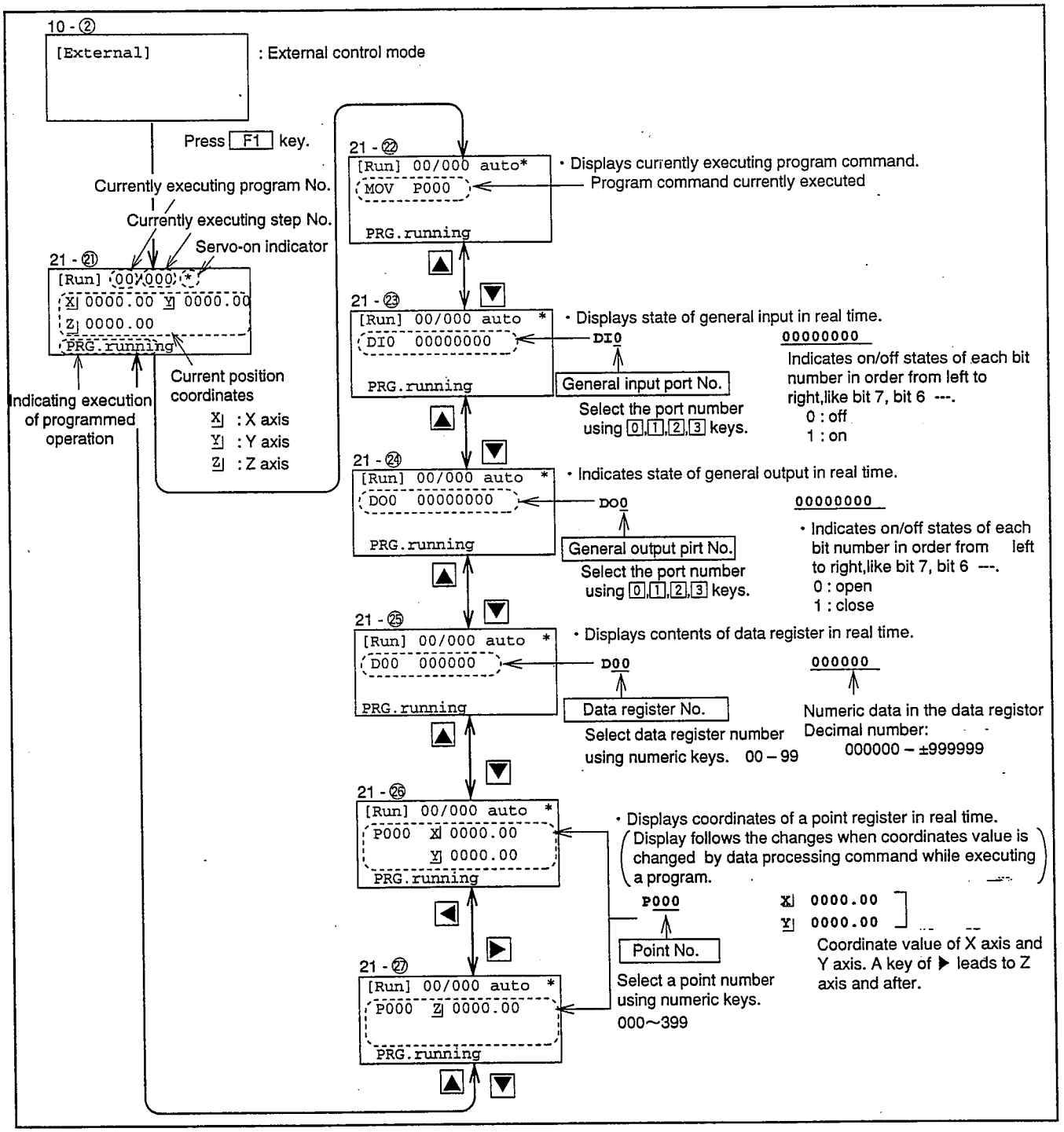
### 21.4.5.2. Monitoring Function of Programmed Operation in External Control Mode

- State of programmed operation in external control mode may be monitored through the teaching box.

**● Monitoring procedures of programmed operation in external control mode**

- Press F1 key in external control mode. Current position coordinate of each axis may be displayed.
- Display screens for program command, general I/O state and other monitoring may be selected using ▲ ▼ keys in current position coordinate display.

*Figure 21-39*






Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

(Blank page)


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Appendix 1: CN5 Encoder and Over Travel Sensor Connector

*Table A-1*

| | |
|---|---|
| Connector on EXC controller | MR-25RFA made by Honda Communication Co. |
| Applicable connector (User's equipment) | MR-25M made by Honda Communication Co. |
| Applicable cover (User's equipment) | MR-25L made by Honda Communication Co. |

### ◉ CN5 pin assignment and signal names

*Figure A-1*

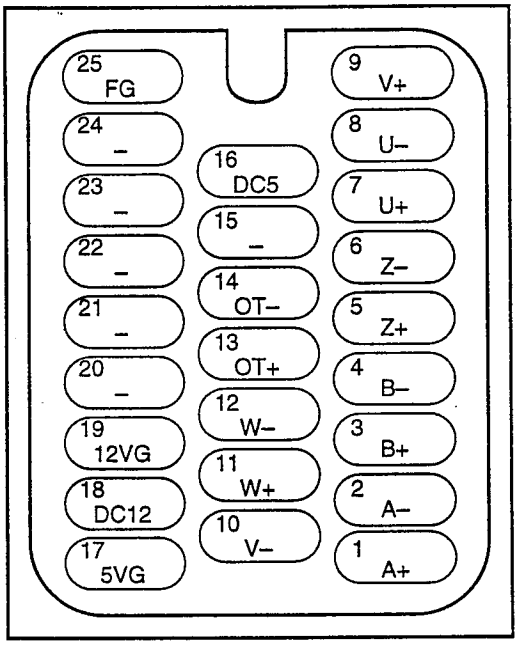



*Table A-2*

| Pin | Signal Name | I/O | Function |
|---|---|---|---|
| 1 | A+ | I | Encoder signal, phase A+ |
| 2 | A- | I | Encoder signal, phase A- |
| 3 | B+ | I | Encoder signal, phase B+ |
| 4 | B- | I | Encoder signal, phase B- |
| 5 | Z+ | I | Encoder signal, phase Z+ |
| 6 | Z- | I | Encoder signal, phase Z- |
| 7 | U+ | I | Encoder signal, phase U+ |
| 8 | U- | I | Encoder signal, phase U- |
| 9 | V+ | I | Encoder signal, phase V+ |
| 10 | V- | I | Encoder signal, phase V- |
| 11 | W+ | I | Encoder signal, phase W+ |
| 12 | W- | I | Encoder signal, phase W- |
| 13 | OT+ | I | Positive (+) direction, over travel |
| 14 | OT- | I | Negative (-) direction, over travel |
| 15 | — | NC | ( Connection disabled) |
| 16 | DC5 | O | Encoder %V power |
| 17 | 5VG | O | Ground, encoder 5V power |
| 18 | DC12 | O | Over travel sensor 12V power |
| 19 | 12VG | O | Ground, over travel sensor 12V power |
| 20 | — | NC | (Connection disabled) |
| 21 | — | NC | (Connection disabled) |
| 22 | — | NC | (Connection disabled) |
| 23 | — | NC | (Connection disabled) |
| 24 | — | NC | (Connection disabled) |
| 25 | FG | O | Cable shield frame ground |

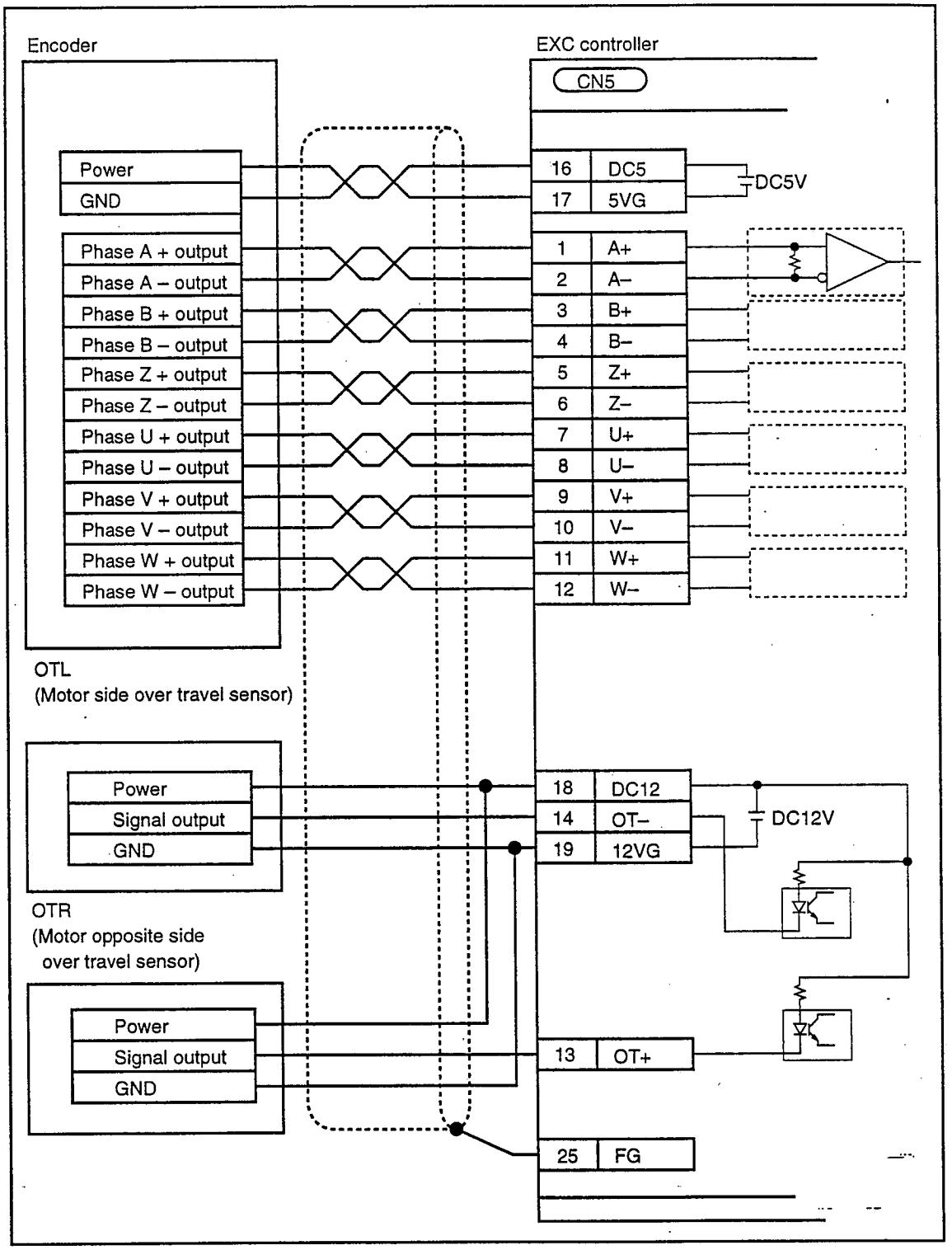
- Each axis has CN5, which is marked as shown below.

  First axis (X axis) ------- 1-CN5
  Second axis (Y axis) ------- 2-CN5
  Third axis (Z axis) ------- 3-CN5


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## ◉ CN5: Wiring method and signal specifications

*Figure A-2*




*Caution : As for the indirect motor mounting type, the direction opposite to the motor is the negative (-) direction. Thus, connect OTR to OT- and OTL to OT+. ( Reverse to the above connection. See "14.5.1.4. Home Return Coordinates.")*



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

### ◉ Encoder signal input specifications

Applicable inputs ----- A+, A-, B+, B-, U+, U-, V+, V-, W+, W-, DC5 and 5GV

*Table A-3*

| Item | | Specification |
|---|---|---|
| DC5V power out put | Line voltage | DC5V±10% |
| | Max. output current | 250mA (per axis) |
| Input format | | Differential type line receiver |
| Line receiver used | | AM26L32A made by TI or equivalent |
| Differential input threshold voltage | | ±0.2V |
| Input impedance | | 220Ω |
| Max. same phase input voltage | | ±7V |

### ◉ Over travel signal input specification

Applicable input ----- OT+, OT-, DC12 and 12VG

*Table A-4*

| Item | | Specification |
|---|---|---|
| DC12V power output | Line voltage | DC12V±10% |
| | Max. output current | 30mA×2 (per axis) |
| Input impedance | | 1.8kΩ |
| Max. allowable input current | | 7mA (per point) |
| Over travel sensor used | | B contact, open collector output |



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Appendix 2 : CN2 Motor and Brake Connector

*Table A-5*

| | |
|---|---|
| Connector on EXC controller | 172039 made by AMP |
| Applicable connector (User's equipment) | 172495 made by AMP |
| Applicable cover (User's equipment) | 172774-1 made by AMP |

### ◉ CN6: Pin assignment and signal

*Figure A-3*

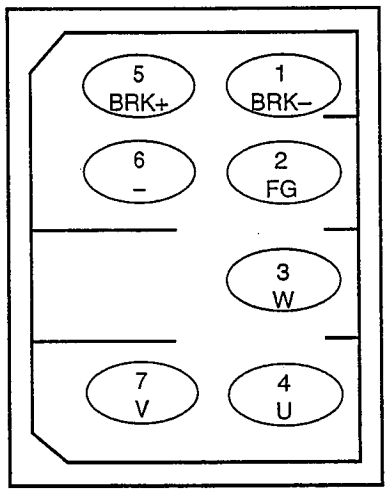



*Table A-6*

| Pin | Signal name | Function |
|---|---|---|
| 1 | BRK– | 0V brake power supply output |
| 2 | FG | Frame ground |
| 3 | W | Motor W phase |
| 4 | U | Motor U phase |
| 5 | BRK+ | 24V brake power supply output |
| 6 | NC | Connection disabled |
| 7 | V | Motor V phase |

- Each axis has CN6, which is marked as shown below.

  First axis (X axis) ------- 1-CN6
  Second axis (Y axis) ------- 2-CN6
  Third axis (Z axis) ------- 3-CN3

*Caution : Rack mount type EXC controller does not have DC24V power supply for brake. The power shall be supplied from CN2. If DC24V power is not supplied, the brake can not be released, which results in an over-load alarm and/or breakage of the brake during operation.*



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## ◉ CN6: Connecting method and signal specification

*Figure A-4*

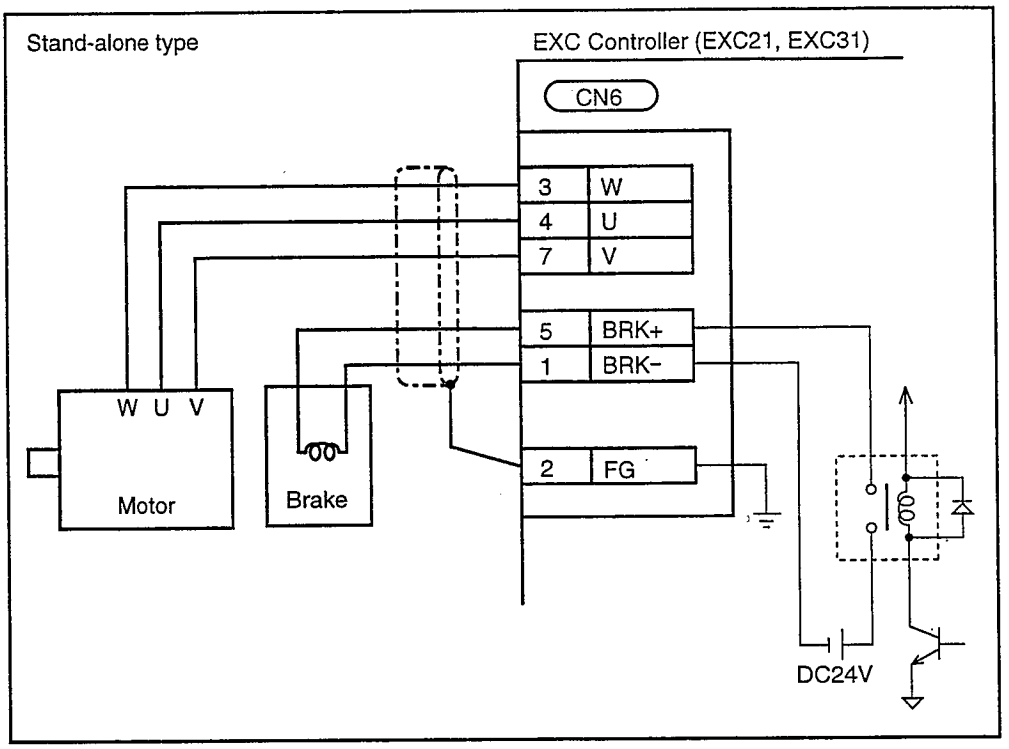
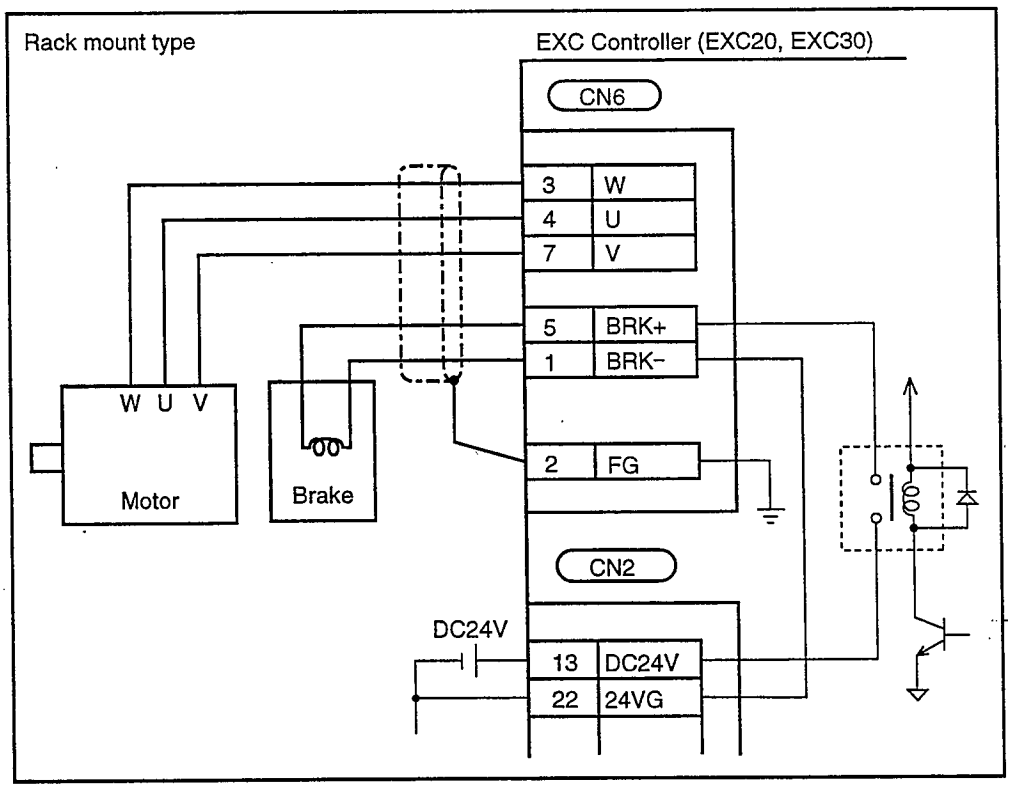



*Figure A-5*






Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## ◉ Motor signal specification

Applicable input ----- U, V, and W

*Table A-7*

| Model | EXC□□A□□□C□□ | | EXC□□A□□□A□□ | |
|---|---|---|---|---|
| Output power | 100W | 300W | 100W | 300W |
| Output voltage | ±140V PWM (AC100V input) | | ±280V PWM (AC200V input) | |
| Rated output current | 2.1Arms | 4.6Arms | 0.9Arms | 1.9Arms |
| Max. output current | 300% of rating | | | |

## ◉ Brake signal specification

Applicable input ----- BRK+ and BRK-

*Table A-8*

| Item | Specification |
|---|---|
| Line voltage | DC24V |
| Rated output current | 400mA |
| Output format | Relay contact output |
| Applied brake | Negative functioning type |



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Appendix 3 : Wiring for Remote Control

- Refer to description below when connecting your personal computer to EXC controller.

### ◉ EXC controller CN1 connector specification

*Table A-9*

| | |
|---|---|
| Connector on EXC controller | DELC-J9SAF-13L6 made by AMP |
| Applicable connector (user's equipment) | DE-9P-N made by AMP |
| Applicable cover (user's equipment) | DE-C1-J6 made by AMP |

### ◉ CN1: Signal name and function

*Table A-10*

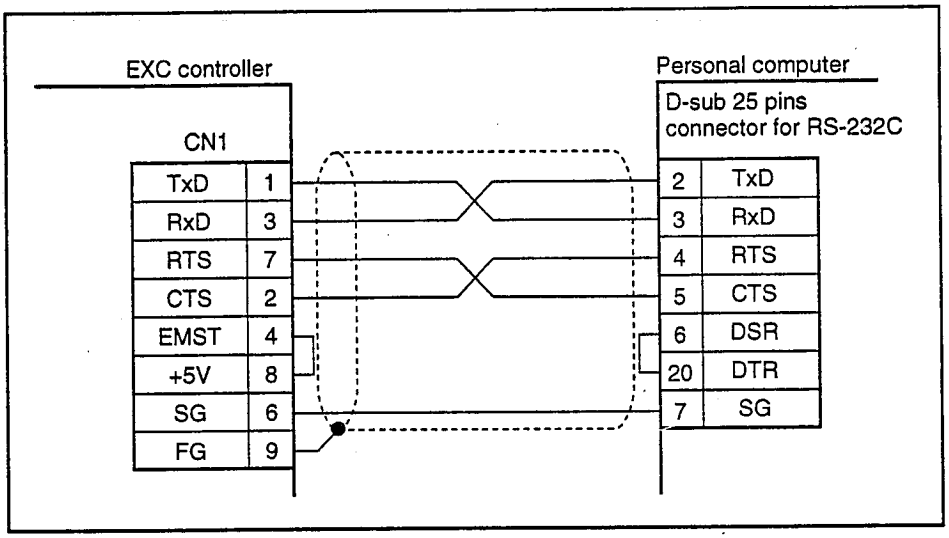
| Pin No. | Signal name | I/O | Function | Note |
|---|---|---|---|---|
| 1 | TXD | Output | Transmit data | |
| 2 | CTS | Input | Clear to send | |
| 3 | RXD | Input | Receive data | |
| 4 | EMST | Input | Emergency stop input | |
| 5 | Type | Output | EXC identification signal | Never connect |
| 6 | SG | – | Digital signal ground | |
| 7 | RTS | Output | Ready to send | |
| 8 | +5V | Output | Power supply to the teaching box | Never connect |
| 9 | FG | – | Frame ground | |


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## ◉ Wiring example

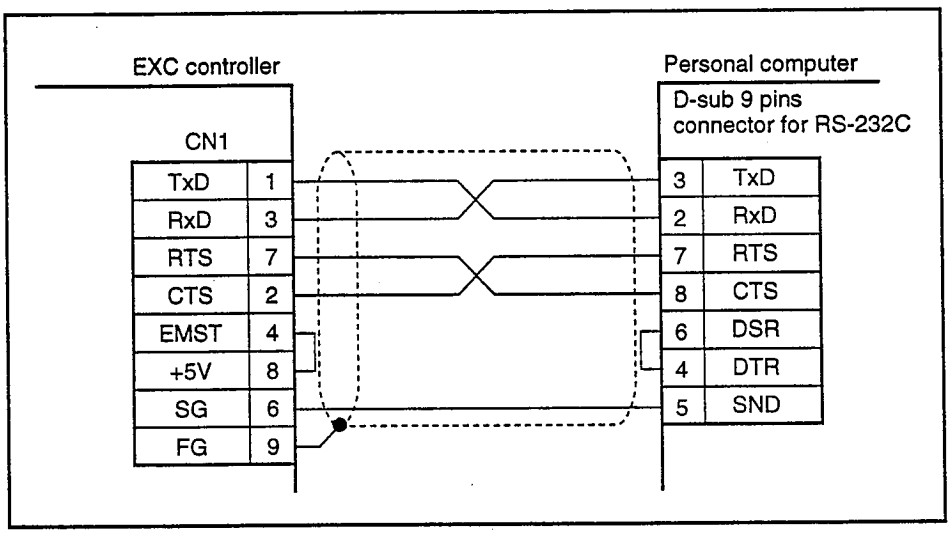
(1) Connecting to PC9801 series

*Figure A-6*




(2) Connecting to IBM PC

*Figure A-7*




### Wiring precautions

① Shielded wires must be used.

② Some personal computer does not have [RTS] terminal. Leave idle the [RTS] terminal of EXC controller in such case. (Do not connect.)

③ Leave idle [Type] terminal of EXC controller. (Do not connect.)

④ FG shall be wired either one of EXC controller or the personal computer. If both are wired, communication may be disterbed by noise.

⑤ The length of shorting wire of [EMST— +5V] of EXC controller and [DSR — DTR] of personal computer must be the minimum. Wire them at the bottom.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Appendix 4: Regeneration Processing

- The motor operates as a generator in one of the following cases. This phenomena of the motor is called regeneration.
  - ① A large inertia load is decelerated: kinetic energy is converted into electric energy.
  - ② A load is lowered along a vertical axis: potential energy is converted into electric energy.

- The electric energy produced by regeneration (regenerative energy) is charged to and stored in the main power source capacitor in the controller. When the regenerative energy exceeds the capacity of the capacitor, the excess regenerative energy is consumed by a dump resistor installed in the controller.

- The dump resistor has a certain limit in terms of capacity. If a large amount of energy is generated in succession, the dump resistor is overheated and an alarm is issued to stop the system.

- Take the following action in this instance:
  - o Decrease operation duty
  - o Decrease acceleration/deceleration
  - o Decrease traveling speed

(1) For a horizontal axis in a standard module (any 200 V module), energy to be processed by a dump resistor is generated when a load mass of 40 kg or above is decelerated from the maximum speed. An overheat alarm may occur if this is repeated in a short time period.

(2) For a vertical axis in a standard module (any 200 V model, S module vertical axis, stroke 230/130 mm), energy to be processed by the dump resistor is not produced. In the case of a vertical axis, however, potential energy is added to kinetic energy and thus the regenerative energy will increase extremely with increasing stroke and load mass. For a unit of special specifications with 20 kg or more load and 200 mm or more stroke, an overheat alarm is easily issued depending on duty.

(3) The guidelines to determine possibility of overheat alarms are described below for your reference.

- o Contact us when you are not sure of your judgment. A special externally mounted regenerative dump resistor of a large capacity is available for the rack type EXC controller. When this is installed, you need not decrease the system performance. Contact your NSK representative for the availability of the external regenerative dump resistor.

* An optional regenerative dump resistor cannot be externally mounted on a stand-alone type controller.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 1. Regenerative processing capacity of EXC controller

- An overheat alarm will be given when the regenerative dump resistor in the EXC controller consumes energy exceeding the level shown in Table A-11.

*Table A-11*

| Ambient temperature | Limit of energy issuing the alarm |
|---|---|
| 25°C | 4.0W |
| 50°C | 2.5W |

- Regenerative energy is processed safely without an alarm if the level of energy to be processed by a regenerative dump resistor (in joule: J) divided by tact time (in seconds: S) is equal to or less than the capacity shown in Table A-11.

## 2. Energy to be processed by regenerative dump resistor

- See Table A-12 and Figures 1 through 6 for the reference levels of energy (in joule: J) to be processed by a regenerative dump resistor.
- For horizontal use, regenerative energy increases with increasing load mass and travel speed.
- For vertical use, regenerative energy increases with increasing load mass, travel speed, and descending stroke.
- In either case, the energy to be processed by a regenerative dump resistor increases with the increasing actual input voltage relative to the rated input voltage (example: inputting 230 VAC for a 200/220 VAC unit).

*Table A-12*

| | Module main unit | Energy to be processed by a dump resistor | Reference level referring to: |
|---|---|---|---|
| Horizontal use | S module | • No problem with the S module. That is, no energy is produced even with the maximum transportable load (20 kg). | |
| | M module<br>H module | • Energy to be processed by a regenerative dump resistor is produced when the system is decelerated from the maximum speed with a load of 40 kg (25 kg for 100 VAC units) or more. | AC200/220V power source : Figure 1<br>AC100/110V power source : Figure 2 |
| Vertical use | S module vertical axis | • Energy to be processed by a regenerative dump resistor is produced when the system is lowered through a stroke of 350 mm (200 mm for 100 VAC units) or more with a load of 15 kg (10 kg for 100 VAC units) or more. | AC200/220V power source : Figure 3<br>AC100/110V power source : Figure 4 |
| | M module<br>H module | • Energy to be processed by a regenerative dump resistor is produced with a load of 20 kg or more. | AC200/220V power source : Figure 5<br>AC100/110V power source : Figure 6 |



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

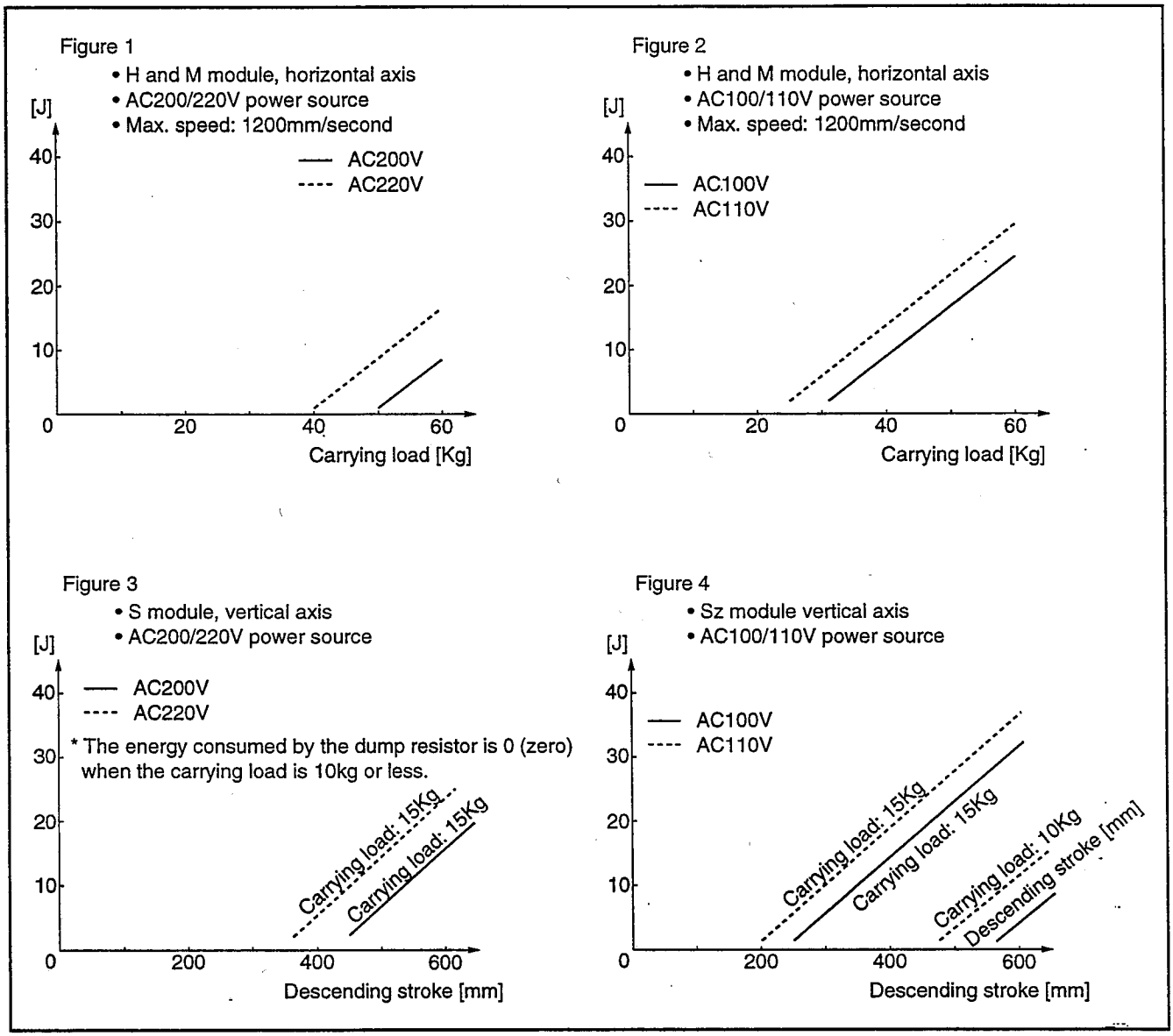
### 3. Possibility of overheat alarms by consumed capacity of regenerative dump resistor

① Calculate total energy of the one tact referring to "2. Energy to be processed by regenerative dump resistor."

② Divide the total energy by tact time (in seconds : S).

③ If the result (unit : W) of (2) is equal to or less than the capacity shown in Table A-11, an alarm won't be issued. If it is over, there is a possibility of occuring overheat alarm.

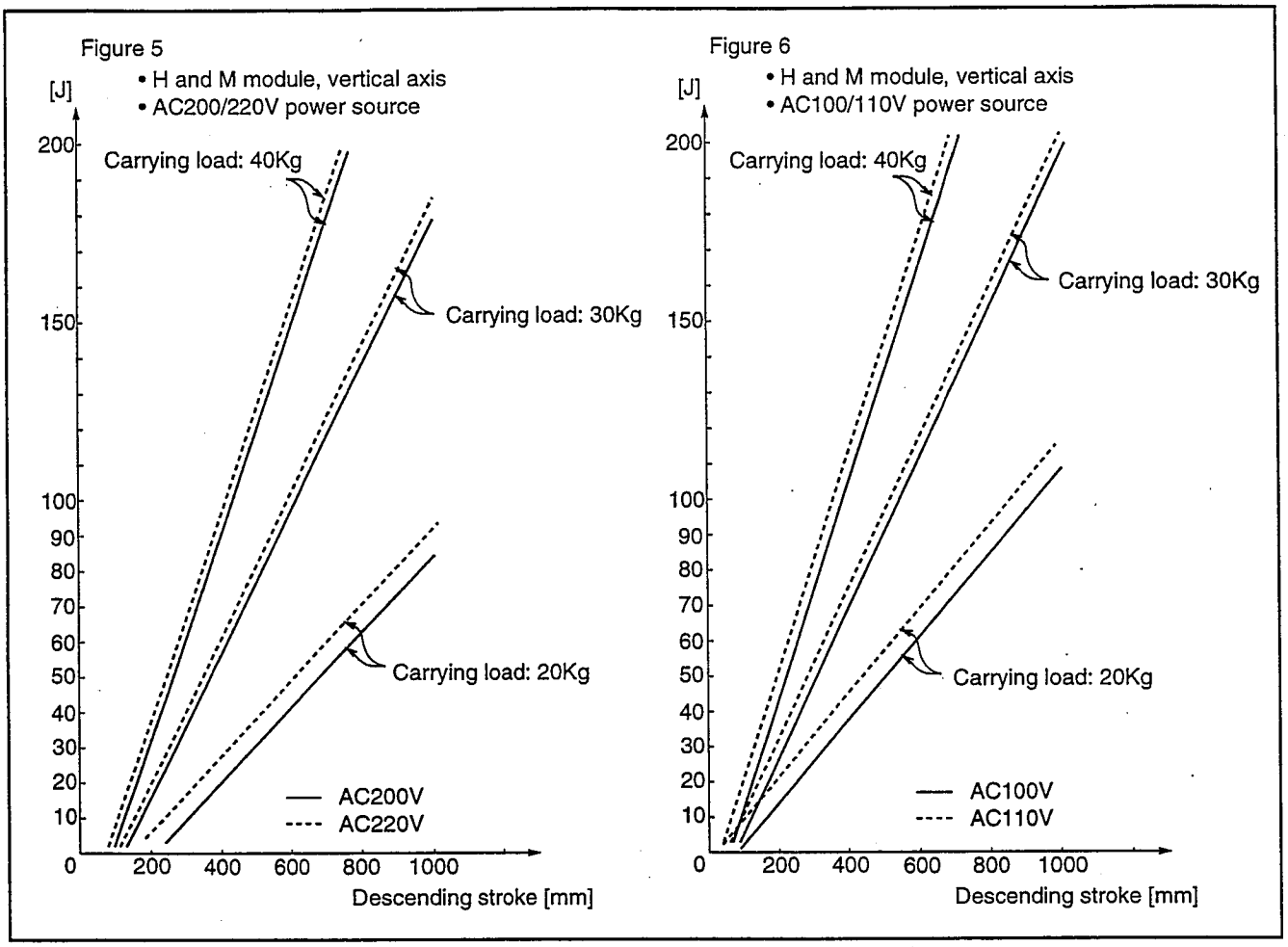
*Figure A-8 : Energy to be processed by a regenerative dump resistor*






Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

*Figure A-9: Energy to be processed by a regenerative dump resistor*






Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## World-wide Manufacturing and Marketing Organization

**NSK Ltd. INTERNATIONAL DIVISION**
JAPAN: Tokyo Phone: 03-3779-7120

**NSK CORPORATION**
U.S.A.: Ann Arbor Phone: 313-761-9500

**[Precision Products Division]**
U.S.A. : Chicago Phone: 708-924-8000
: Los Angeles Phone: 213-926-3578
: Ann Arbor Phone: 313-761-9500

**NSK-RHP CANADA INC.**
CANADA : Toront Phone: 905-890-0740
: Edomonton Phone: 403-434-3417
: Montreal Phone: 514-735-5446
: Vancouver Phone: 604-229-1151

**NSK RODAMIENTOS MEXICANA, S.A. DE C.V.**
MEXICO: Mexico City Phone: 5-301-2741,5-301-3115

**NSK DO BRASIL INDUSTRIA E COMÉRCIO DE ROLAMENTOS LTDA.**
BRASIL : São Paulo Phone: 001-269-4700
: Porto Alegre Phone: 051-222-1324
: Belo Horizonte Phone: 031-224-2508

**NSK-RHP UK LTD**
ENGLAND : Ruddington Phone: 0115-936-6600

**NSK-RHP DEUTSCHLAND G.m.b.H**
GERMANY : Düsseldorf Phone: 02102-4810
: Frankfurt Phone: 06105-21016
: Stuttgart Phone: 0711-79082-0
: Leipzig Phone: 0341-5631241-242

**NSK-RHP FRANCE S.A.**
FRANCE : Paris Phone:1.30.57.39.39
: Lyon Phone: 72.15.29.00

**NSK-RHP NEDERLAND B.V.**
NETHERLAND: Amsterdam Phone: 020-6470711

**NSK-RHP ITALIA S.p.A.**
ITALIA: Milano Phone: 02-99025771

**NSK-RHP AUSTRALIA PTY, LTD.**
AUSTRALIA : Melbourne Phone: 03-9764-8302
: Sydney Phone: 02-893-8322
: Brisbane Phone: 07-3393-1388
: Adelaide Phone: 08-373-4811
: Perth Phone: 09-434-1311

**NSK-RHP BEARING NEW ZEALAND LTD.**
NEW ZEALAND: Auckland Phone: 09-276-4992

**NSK SINGAPORE (PRIVATE) LTD.**
SINGAPORE: Singapore Phone: 2781711

**NSK BEARINGS (THAILAND) CO., LTD.**
THAILAND : Bangkok Phone: 2-6412150-60
: Chiang mai Phone: 053-246993~4

**HANWHA NSK PRECISION CO., LTD.**
KOREA : Seoul Phone: 02-3400-5000

**TAIWAN NSK PRECISION CO., LTD.**
TAIWAN: Taipei Phone: 02-591-0656

**NSK REPRESENTATIVE OFFICE**
KOREA: Seoul Phone: 02-779-6300
INDONESIA: Jakarta Phone: 021-314-1708

**Robot Modules System**

- **Module Main Unit**
- **EXC Controller**

**User's Manual** 3

**= Maintenance =**

Document Number: K20012-01

October 10th, 1996 1st Edition 1st Printing
October 30th, 1996 1st Edition 2st Printing

NSK Ltd.
Precision Machinery & Parts Technology Centre
Mechatronics Product Engineering Dept.
78 Toriba-machi, Maebashi-shi, Gunma-ken 371 Japan
Phone: 0272-54-7734 Fax: 0272-52-1197

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

**Artisan Technology Group** is an independent supplier of quality pre-owned equipment

## Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

## We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

## Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP