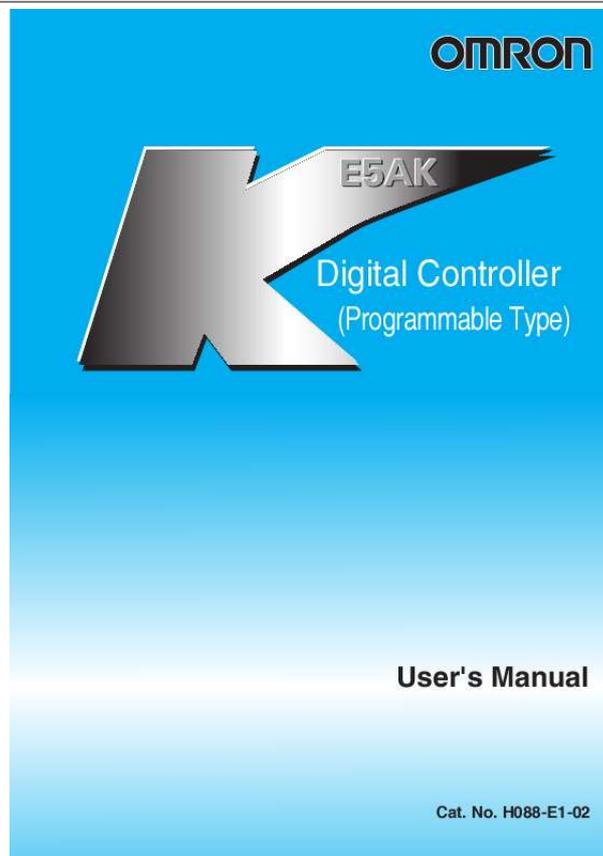




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Manual abstract:

No. @@@@This User's Manual describes how to use the E5AK-T. @@Also, store this manual in a safe place so that it can be retrieved whenever necessary. PRECAUTIONS IN USING THE PRODUCT When the product is used under the circumstances or environment below, ensure adherence to limitations of the ratings and functions. Also, take countermeasures for safety precautions such as fail-safe installations. (1) Use under circumstances or environments which are not described in this user's manual. (2) Use for nuclear power control, railway, air craft, vehicle, incinerator, medical equipment, entertainment equipment, safety device, etc. (3) Use for applications where death or serious property damage is possible and extensive safety precautions are required. About this manual (1) All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form, or by any means, mechanical, electronic, photocopying, recording, or otherwise, without the prior written permission of OMRON.

(2) Moreover, because OMRON is constantly striving to improve its high-quality products, the information in this manual is subject to change without notice. (3) Every precaution has been taken in the preparation of this manual. Nevertheless, if you find any errors or omissions, please contact the branch of OMRON or sales office listed at the end of this manual, and inform them of the catalog No. on the front cover. I Conventions Used in This Manual J Meanings of

Abbreviations Sometimes the following abbreviations are used in parameter names, figures and in text explanations.

These abbreviations mean the following: Symbol PV SP LBA HB AT EU Process value (Present) set point *1 Loop break alarm Heater burnout Auto-tuning Engineering unit *2 Term *1 In program pattern diagrams, the present SP is indicated. *2 _C, m, g and other units are indicated for scaled data. However, "EU" is used as the minimum unit for the data. For example, for "50.02 (m)", 1EU is taken as the minimum unit 0.

01 (m). J How to Read Display Symbols The following tables show the correspondence between the symbols displayed on the displays and alphabet characters. ABCDEF GHI JKLM N O P Q R S T U V WX Y Z J "Reference" mark This mark indicates that extra, useful information follows, such as supplementary explanations and how to apply functions. II J How This Manual is Organized Purpose Title Description This chapter describes the features of the E5AK-T, names of parts, and typical functions. D Learning about the gener- Chapter 1 INTRODUCTION al features of the E5AK-T D Setting up Chapter 2 TIONS PREPARA- This chapter describes the operations that you must carry out (e.g. installation, wiring and switch settings) before you can use the E5AK-T. D Basic E5AK-T operations Chapter 3 TION Chapter 5 BASIC OPERA- These chapters describe using basic control examples how to PARAMETERS use the front panel keys and how to view the display when setting the parameters of the major functions for the E5AK-T. These chapters describes the important functions of the E5AK-T and how to use the parameters for making full use of the E5AK-T. This chapter describes how to use the functions related specifically to position-proportional type controllers.

This chapter mainly describes how to use the communications commands, and gives program examples. D Applied tions E5AK-T opera- Chapter 4 APPLIED OPERATION Chapter 5 PARAMETERS D Using a Position-propor- Chapter 4 APPLIED OPERATION tional type controller /4.1 Selecting the Control Method D Communications with a Chapter 6 USING THE COMMUNICATIONS host computer FUNCTION D Calibration Chapter 7 CALIBRATION This chapter describes how the user should calibrate the E5AK-T. This chapter describes what to do if any problems occur. D Troubleshooting Chapter 8 TROUBLESHOOTING III PRECAUTIONS ON SAFETY F Marks For Ensuring Safe Use and Their Meanings This manual uses the following marks to indicate precautions for ensuring that the E5AK-T is used safely. The precautions indicated below describe important information regarding safety. Be sure to follow the instructions described in these precautions. WARNING Incorrect handling may cause death or injury. WARNING Do not touch the terminals while the power is ON. This may cause an electric shock.

IV NOTICE Be sure to observe these precautions to ensure safe use. F Do not use the product in places where explosive or flammable gases may be present. F Never disassemble, repair or modify the product. F Tighten the terminal screws properly. F Use the specified size of solderless terminals for wiring. F Use the product within the rated supply voltage. F Use the product within the rated load. F The life expectancy of the output relay varies considerably according to its switching capacity and operating conditions. Be sure to use the output relay within its rated load and electrical life expectancy. If the output relay is used beyond its life expectancy, its contacts may become fused or burned.

F If you remove the controller from its case, never touch nor apply shock to the electronic parts inside. F Do not cover the E5AK-T. (Ensure sufficient space around the controller to allow heat radiation.) F Do not use the controller in the following places: · Places subject to icing, condensation, dust, corrosive gas (especially sulfide gas or ammonia gas). · Places subject vibration and large shocks. · Places subject to splashing liquid or oil atmosphere. · Places subject to intense temperature changes. · Places subject to heat radiation from a furnace. F Be sure to wire properly with correct polarity of terminals. F When wiring input or output lines to your controller, keep the following points in mind to reduce the influence from inductive noise: · Allow adequate space between the high voltage/current power lines and the input/output lines.

· Avoid parallel or common wiring with high voltage sources and power lines carrying large currents. · Using separating pipes, ducts, and shielded line is also useful in protecting the controller, and its lines from inductive noise. F Cleaning: Do not use paint thinner or organic solvents. Use standard grade alcohol to clean the product. F Use a voltage (100 to 240 VAC at 50 to 60 Hz). At power ON, the prescribed voltage level must be attained within two seconds. F Allow as much space as possible between the controller and devices that generate a powerful high frequency (high-frequency welders, high-frequency sewing machines, etc.) or surge. These devices may cause malfunctions. F If there is a large power-generating peripheral device and any of its lines near the controller, attach a surge suppressor or noise filter to the device to stop the noise affecting the controller system.

In particular, motors, transformers, solenoids and magnetic coils have an inductance component, and therefore can generate very strong noise.



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F When mounting a noise filter on the power supply to the controller, be sure to first check the filter's voltage and current capacity, and then mount the filter as close as possible to the controller. V F Use within the following temperature and humidity ranges: · Temperature: -10_C to 55_C, humidity: 35%RH to 85%RH (with no icing or condensation) If the controller is installed inside a control board, the ambient temperature must be kept to under 55_C, including the temperature around the controller. If the controller is subjected to heat radiation, use a fan to cool the surface of the controller to under 55_C. F Store within the following temperature and humidity ranges: · Temperature: -25_C to 65_C, humidity: 35%RH to 85%RH (with no icing or condensation) F Never place heavy objects on, or apply pressure to the controller that may cause it to deform and deteriorate during use or storage.

F Avoid using the controller in places near a radio, television set, or wireless installation. These devices can cause radio disturbances which adversely affect the performance of the controller. VI Table of Contents Preface . . .

.....

.....

.....

.....

..... I Conventions Used in This Manual

.....

II Precautions on Safety

.....

.....

..... V CHAPTER 1 INTRODUCTION

.....

.....

.....

.. This chapter introduces the names of parts on the E5AK-T and their functions. For details on how to use the controller and parameter settings, see Chapter 2 onwards. 1--1 1.1 1.2 1.3 1.4 1.5 1.

6 Names of parts

.....

.....

.....

.....

.....

.. Input and Output

.....

.....

.....

.....

... Program

.....

.....

.....

.....

.....

.....

. Parameters and Menus

.....

.....

.....

..... About the Communications Function

.....

.....

... About Calibration .

.....

.....

.....

.....

..... 1--2 1--5 1--8 1--9 1--12 1--13 CHAPTER 2 PREPARATIONS .

.....

.....
.....

..... This chapter describes the operations (e.g. setup, installation and wiring) you should carry out before turning the E5AK-T ON. 2--1 2--2 2--5 2--8 2.

1 Setup

.....
.....
.....

.....
.....
.....

2.2 Installation

.....
.....
.....
.....

..... 2.3 Wiring Terminals ..

.....
.....
.....

.....
.....

..... CHAPTER 3 BASIC OPERATION .

.....
.....

.....
... 3.1 3.

2 3.3 3.4 3.5 3.6 3.

7 3.8 Convention Used in this Chapter

.....
.....

... Setting Input Specifications ..

.....
.....

.....
.....

.... Setting Output Specifications .

.....
.....

.....
.....

.... Setting Alarm Type .

.....
.....

.....
.....

..... Setting Patterns ..

.....
.....
.....
.....

..... Protect Mode .

.....
.....
.....

.....
.....
.....

... Starting and Stopping Operation

.....
.....
.....

Adjusting Control Operation

.....
.....
.....

3--1 3--2 3--4 3--7 3--10 3--14 3--19 3--21 3--22 This chapter describes actual examples for understanding the basic operation of the E5AK-T. CHAPTER 4 APPLIED OPERATION

.....
.... 4--1 This chapter describes each of the parameters required for making full use of the features of the E5AK-T. Read this chapter while referring to the parameter descriptions in chapter 5. 4.1 4.2 4.3 4.4 Selecting the Control Method

.....
.....
.....

Operating Condition Restrictions

.....
.....

.. Ramp Rise Rate Setup Program ...

.....

.... Program Operation .

.....
.....

.....
.....

.. 4--2 4--7 4--9 4--13 4.5 4.6 4.7 4.8 4.9 4.10 4.11 Wait Operation .

.....
.....
.....

.....
.....

..... How to Use the Error Output .

.....
.....
.....

..... Checking Operation Restrictions .

.....
.....
.....

..... 8--2 8--3 8--5 8--6 APPENDIX SPECIFICATIONS

.....
.....
.....

A--2 ABOUT CURRENT TRANSFORMER (CT) ... A--5 CONTROL BLOCK DIAGRAM

..... A--6 SETTING LIST ...

.....
.....
.....

... A--8 MODEL LIST

.....
.....
.....

... A--12 PARAMETER OPERATIONS LIST

... A--13 ASCII CODE LIST ..

.....
.....

..... A--15 INDEX REVISION HISTORY CHAPTER 1 INTRODUCTION CHAPTER 1 INTRODUCTION This chapter introduces the names of parts on the E5AK-T and their functions. For details on how to use the controller and parameter settings, see Chapter 2 onwards. 1.

1 Names of parts

.....
.....

... Main parts

.....
.....
.....

.. Front panel

.....
.....

..... About the displays .

.....
.....
.....

How to use keys

.....

... 1.2 Input and Output .

.....
.....

..... Input

.....
.....
.....

..... Output .

.....
.....
.....

... 1.3 Program ...

.....
.....

.. How programs are structured ...

.....

... Program operation

.....
.....

... Alarm output .

.....
.....

.....
Program output

.....
.....

.... 1.4 Parameters and Menus

.....
.....

.. Parameter types

.....
.....

Selecting modes

.....

..... Selecting parameters ..

.....
.....

..... Fixing settings ..

.....
.....
.....

... 1.5 About the Communications Function 1.6 About Calibration .

.....
.....
.....

. 1-2 1-2 1-2 1-3 1-4 1-5 1-5 1-6 1-8 1-8 1-8 1-8 1-8 1-9 1-9 1-10 1-11 1-11 1-12 1-13 1--1 CHAPTER 1 INTRODUCTION 1.1 Names of parts J Main parts
Terminals P 2-6 Rear case Front panel This page J Front panel Program state indicators No.1 display Bar graph Operation status indicators Pattern No.
OUT1 SUB1 MANU HOLD WAIT OUT2 SUB2 RMT RST AT No.2 display E5AK Run/Reset key RUN/RST Display key Down key Up key 1--2 1.1 Names of
parts J About the displays F No.1 display F No.2 display F Pattern No. F Program status indicators F Operation status indicators Displays the process value
or parameter symbols.

Displays the set point, manipulated variable or parameter settings. Displays pattern No.. Indicate how the present-SP of the operating step changes. · OUT1
Lights when the pulse output function assigned to "control output 1" is ON. · OUT2 Lights when the pulse output function assigned to "control output 2" is
ON. · SUB1 Lights when the pulse output function assigned to "auxiliary output 1" is ON. · SUB2 Lights when the pulse output function assigned to "auxiliary
output 2" is ON. · MANU Lights in the manual operation mode. · RST Lights when the control is in reset status.
· RMT Lights during remote operation. · HOLD Lights when the program is in hold status. · WAIT Lights when the program is in wait status. · AT Flashes
during auto-tuning. F Bar graph · This bar graph indicates how much of the pattern has elapsed in 20% increments (five stages) per single segment.
1--3 CHAPTER 1 INTRODUCTION J How to use keys F RUN/RST The following describes basic key operations. To change to run operation from the reset
status, press this key for one second minimum.



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To change to the reset status from run operation, press this key for two seconds minimum. The functions of this key change according to how long it is pressed. If the key is pressed for less than one second, the parameters are switched.

If the key is pressed for one second minimum, the menu display appears. In key operations from here on, "press the key" refers to pressing the key for less than one second. For details on switching of parameters and menu display items, see page 1-10. Key increments or advances the values or settings on Each press of the No.2 display, while each press of the key decrements or returns the values or settings on the No.2 display. Key F key F key Functions vary, for example, when the key is held down simultaneously with the RUN/RST key, or a key is held down continuously. For details, see page 1-10. Also, chapters 3 and 4 describe examples using various key combinations. 1--4 1.

2 Input and Output 1.2 Input and Output Temperature input Voltage input Current input Controller Control output (heat) Control output (cool) Alarm 1 Control output 1 Control output 2 CT input Potentiometer Alarm 2 Alarm 3 HBA LBA Auxiliary output 1 Auxiliary output 2 Event input Time signal 1 Time signal 2 Program end Stage output Error 1 Error 2 Transfer output J Input The E5AK-T supports the following inputs: Temperature input, Current input, Voltage input, CT input/potentiometer, and Event input. F Temperature input/Voltage input/Current input · Only one of temperature input, current input and voltage input can be selected and connected to the controller. · The following input sensors can be connected for temperature input: Thermocouple: K, J, T, E, L, U, N, R, S, B, W, PLII Platinum resistance thermometer: JPt100, Pt100 · The following currents can be connected for current input: 4 to 20 mA, 0 to 20 mA · The following voltages can be connected for voltage input: 1 to 5 VDC, 0 to 5 VDC, 0 to 10 VDC F CT input/Potentiometer · Connect CT input when using the HBA (heater burnout alarm) function on a standard type controller (E5AK-TAA2). Note that CT input cannot be used when the linear output unit is mounted. · Connect the potentiometer when monitoring the valve opening on a position-proportional type controller (E5AK-TPRR2). 1--5 CHAPTER 1 INTRODUCTION F Event input Add on the input unit (E53-CKB) when using event input. You can select from the following six event inputs: Run/Reset, Remote/Local, Auto/Manual, Hold/Cancel, Advance, Pattern J Output The output functions of the E5AK-T do not operate for five seconds after the E5AK-T is turned ON. The E5AK-T supports the following five outputs: Control output 1 Control output 2 Auxiliary output 1 Auxiliary output 2 Transfer output When using control output 1 and 2, set the output unit (sold separately). Nine output units are available to suit the output circuit configuration. When using transfer output, add on the communication unit (E53-AKF). F Output assignments · The E5AK-T supports the following thirteen output functions: Control output (heat), Control output (cool), Alarms 1 to 3, HBA, LBA, Time Signals 1 and 2, Program End, Stage Output, Error 1 (input error), Error 2 (A/D converter error) · Assign these output functions to control output 1, control output 2, auxiliary output 1, and auxiliary output 2. However, note that as control output 1 is used as the open output and control output 2 is used as close output on a position-proportional type controller (E5AK-TPRR2), control outputs 1 and 2 cannot be used as assignment destinations. Also, of the output functions, control output (heat), control output (cool), HBA and LBA are disabled. · On a standard type controller, there are restrictions on how assignment destinations (control output 1, control output 2, auxiliary output 1, and auxiliary output 2) can be used.

For details, see Chapter 3 Basic Operation/3.3 Setting Output Specifications (page 3-7). · In the example on the previous page, "control output (heat)" is assigned to "control output 1", "alarm 1" is assigned to "control output 2", and "alarm 2" is assigned to "auxiliary output 1". Accordingly, the configuration is such that heating control output is connected to control output 1, and alarm output is connected to control output 2 and auxiliary output 1. · Control outputs 1 and 2 are used depending on the differences in control method as follows: 1--6 1.

2 Input and Output Control Method Standard control Heating and cooling control Position-proportional control Model E5AK-TAA2 AC100-240 E5AK-TAA2 AC/DC24 E5AK-TAA2 AC100-240 E5AK-TAA2 AC/DC24 Control Output 1/ Control Output 2 Control output (heat) / Alarm, etc. Control output (heat) / Control output (cool) E5AK-TPRR2 AC100-240 Open/Close E5AK-TPRR2 AC/DC24 F Transfer output · The E5AK-T supports the following five transfer outputs: Set point, Process value, Heating side manipulated variable, Cooling side manipulated variable, Valve opening However, note that heating/cooling side manipulated variables can be output only on standard type controllers, and valve opening can be output only on position-proportional type controllers. · These transfer outputs can be output after being scaled. 1--7 CHAPTER 1 INTRODUCTION 1.3 Program J How programs are structured E5AK-T allows you to configure programs made up of a maximum of eight patterns (pattern 0 to 7). The number of steps (16 maximum) in each pattern can be specified in parameters. Pattern 7 Pattern 1 Pattern 0 Step 0 Step 1 Step 2 Step 15 · Generally, the "time setup method" is used to configure programs. By this method, set points at each step and time are used as program elements. However, the "ramp rise rate setup method" can also be used. By this method, the set point, ramp time and soak times are used as program elements.

J Program tion opera- · Generally, the target patterns are specified before the program is executed. · In parameter setup, you can specify repeated execution of the same pattern (Repeat) or consecutive execution of all patterns 0 to 7 (Run all). · During program operation, steps can be skipped (Advance) and the control monitoring can be paused (Hold). · When the wait width is specified in parameter setup, the program does not go to the next step and waits until the PV reaches the specified time (wait width) at the end of each step. · Alarms that are assigned as outputs operate referenced to the alarm values preset to each pattern. · Time signals, program end and stage output can be output according to output assignment. · ON/OFF signals are output as time signals according to the timer that takes a specified step as its start point.



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F Step operation F Wait operation J Alarm output J Program output 1--8 1.4 Parameters and Menus 1.4 Parameters and Menus J Parameter types E5AK-T parameters are distributed between the following ten modes: Protect mode Manual mode Level 0 mode Program mode Level 1 mode Level 2 mode Setup mode Expansion mode Option mode Calibration mode The settings of parameters in each of eight modes (excluding the protect mode and manual mode) can be checked and modified by selection on the menu display.

F Protect mode The protect function is for preventing unwanted modification of parameters, and switching between run and reset operation or auto and manual operation. In this mode, the controller can be switched to manual operation. The manipulated variable can be manipulated manually only in this mode. Set the controller to this mode during normal operation. In this mode, you can change the set point and pattern during operation, and execute step operation (e.

g. advance). You can only monitor (not change) the process value, step No., standby time, pattern elapsing time, pattern execution count and manipulated variable. This is the programming mode.

In this mode, you can set the number of steps used in each pattern, pattern execution count, alarm values, set points for each step, step time, and time signals for two steps. This is the main mode for adjusting control. In this mode, you can execute AT (auto-tuning), and set up the control period, PID parameters and heater burnout alarm (HBA) conditions. This is the auxiliary mode for adjusting control. In this mode, you can set the parameters for limiting the manipulated variable, switch between the remote and local modes, and set the loop break alarm (LBA), alarm hysteresis and the digital filter value of inputs. This is the mode for setting the basic specifications. In this mode, you can set parameters that must be checked or set before operation such as the input type, scaling, output assignments and direct/reverse operation. 1--9 F Manual mode F Level 0 mode F Program mode F Level 1 mode F Level 2 mode F Setup mode

CHAPTER 1 INTRODUCTION F Expansion mode This is the mode for setting expanded functions. In this mode, you can set SP setting limiter, switching between advanced PID control or ON/OFF control, program time unit, selection of step time/rate of rise programming, time unit of ramp rise rate, and the time for automatic return to the monitoring display. This is the mode for setting optional functions.

You can select this mode only when an option unit is mounted in the controller. In this mode, you can set the communications conditions, transfer output and event input parameters to match the type of option unit mount in the controller. Heater burnout alarm function and position-proportional travel time are also located in this mode. This mode is provided so that the user can calibrate inputs and output. When calibrating input, the selected input type is calibrated.

Whereas, transfer output can be calibrated only when the communication unit (E53-AKF) is set in the controller. The following diagram shows the order in which modes are selected. Power ON 1 second min. F Option mode F Calibration mode J Selecting modes + 1 second min. Level 0 mode 1 second min.

Manual mode Program mode 1 second min. + 1 second min. Level 1 mode 1 second min. RUN/RST + RUN/RST + 1 second min. 1 second min.

Level 2 mode 1 second min. Protect mode RUN/RST Setup mode 1 second min. + 1 second min. Expansion mode 1 second min. Option mode 1 second min. Calibration mode · To select the menu display in any of the above modes (excluding the key for 1 second miniprotect mode and manual mode), press the mum.

When you have selected the menu display, the previous mode is selected. For example, if you selected the menu display while in the J as shown on the left. level 0 mode, the No.2 display changes to [· To move to the desired mode after you have entered the menu display, keys and hold down the select the desired mode using the key for one second minimum. The display switches to the first parameter of the mode that you specified. 1--10 1.4 Parameters and Menus · Protected modes cannot be selected. Also, the menu display does not appear when modes are protected up to the program mode.], [], [] or [] in the menu display, · If you select [the level 0, program, level 1 and level 2 modes, respectively, are selected.

These modes are selected with control still continuing.][][] or [] in the menu display, the · If you select[setup, expansion, option and calibration modes, respectively, are selected. When these modes are selected, the control is reset. So, control outputs and auxiliary output are turned OFF. When another mode is selected while in these modes control, reset is canceled. · To set the controller to the protect mode or to return to the level 0 mode from the protect mode, press the simultaneously for 1 second minimum. · To set the controller to the manual mode, press the key for one key held down in the level 0 to 2 second minimum with the modes. To return to the level 0 mode in the manual mode, press the key for one second minimum with the key pressed. Be sure key first in this operation. to press the RUN/RST key and the key J Selecting parameters · When the controller is not in the manual mode, each press of the key switches the parameter in the respective mode.

Parameter 1 Parameter 2 Parameter 3 Parameter n J Fixing settings · If you press the key when at the final parameter, the display returns to the top parameter for the current mode. · When you change parameter settings or contents, specify the parameor keys, and either leave the setting for at least ter using the key. This fixes the setting. two seconds or press the · When another mode is selected, the content of the parameters before the mode was selected is fixed. · When you turn the power OFF, you must first fix the settings and pakey or selecting another rameter contents (by pressing the mode).

The settings and parameter contents are sometimes not or keys. changed by merely pressing the 1--11 CHAPTER 1 INTRODUCTION 1.5 About the Communications Function The E5AK-T can be provided with a communications function that allows you to check and set controller parameters from a host computer. If the communications function is required, add on the communications unit. For details on the communications function, refer to Chapter 6. F RS-232C When using the communications function on the RS-232C interface, add on the communications unit (E53-AK01). When using the communications function on the RS-422 interface, add on the communications unit (E53-AK02). When using the communications function on the RS-485 interface, add on the communications unit (E53-AK03). F RS-422 F RS-485 1--12 1.6 About Calibration 1.



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internal mechanism from the housing, prepare a Phillips screwdriver matched to the size of the screw on the lower part of the front panel. (1) Press down on the hook on the top of the front panel, and turn the Phillips screwdriver to the left to loosen the screw on the lower part of the front panel.

(2) Draw out the internal mechanism towards you holding both sides of the front panel. Fixing Screw for Front Panel Tighten this screw by a torque of 0.3 to 0.5 Nm (approx. 3 to 5 kgfcm).

2--2 2.1 Setup J Setting up the output unit F Before setup · Check the type of the output unit you are about to set up. · For details on types of output unit and main specifications, see page 2-7. F Procedure (1) Check the positions of the sockets you are about to insert the output units into as shown in the following diagram. OUT1 OUT2 Bracket (2) Insert the output unit for control output 1 into the socket "OUT1" and the output unit for control output 2 into the socket "OUT2". (3) Fasten the output units with the bracket (accessory). 2--3 CHAPTER 2 PREPARATIONS J Setting up the option unit F Before setup · Check the type of the option unit you are about to set up. · For details on types of option unit and main specifications, see Appendix, Model List (page A-12) and Appendix, Option Unit Ratings and Characteristics (page A-4). · For details on the relationship between units and terminals, see page 2-8. F Procedure (1) Remove the power board and option boards in the order shown in the following diagram.

2 1 (2) Insert the option units into the sockets for options 1 to 3. The following diagram shows the relationship between option units and mounting positions. Option 1 E53--AKB: Event inputs 1/2 E53--AK01: RS--232C E53--AK02: RS--422 E53--AK03: RS--485 Option 3 E53--AKB: Event inputs 3/4 Option 2 E53--AKF: Transfer output (3) Mount the option boards and the power board in the order shown. 2--4 2.2 Installation 2.2 Installation J Dimensions 96j 13.5 100 J Panel cutout Unit (mm) 110 min. 120 min. 92 +0.8 0 · Recommended panel thickness is 1 to 8 mm.

+0.8 0 92 · Maintain the specified vertical and horizontal mounting space between each controller. Controllers must not be closely mounted vertically or horizontally. 112 j 91 2--5 CHAPTER 2 PREPARATIONS J Mounting (1) Insert the E5AK-T controller into the mounting hole in the panel. (2) Fit the mounting bracket (accessory) into the fixing slots on the top and bottom of the rear case.

(3) Tighten the mounting bracket screws alternately a little at a time until the ratchet starts to slide. 2--6 2.2 Installation F Setting up the terminal covers · Fasten the terminal covers (E53-COV0809) to protect terminals. · E5AK-VV2-500 controller is provided with terminal covers. · Use E53-COV09 for terminals 1 to 10, and E53-COV08 for terminals 11 to 33.

· Fasten the terminal covers as follows by using the snap pins. E5AK-T E53-COV0809 · To remove the terminal covers, pull the edges of the snap pins. 2--7 CHAPTER 2 PREPARATIONS 2.3 Wiring Terminals J Terminal arrangement SOURCE 10 9 8 7 6 5 4 3 2 1 TRSF 30 31 32 20 19 29 28 27 26 18 17 16 15 14 13 12 11 EV1/2 RS232C RS422 RS485 OUT1 OUT2 SUB1 SUB2 CT PTMR TC Pt I V EV3/4 25 24 23 22 21 33 TRSF : Transfer output EV1 to 4 : Event inputs PTMR : Potentiometer SOURCE : 100 to 240 VAC, 50/60 Hz 16VA or 24VAC/DC, 50/60 Hz, 12VA 8W J Precautions when wiring · On some models, terminals are not used and are left free. Do not wire these terminals. · Separate input leads and power lines in order to protect the controller and its lines from external noise. · We recommend using solderless terminals when wiring the controller. · Tighten the terminal screws using a torque no greater than 0.



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78 Njm (8kgf/cm). · Use the following type of solderless terminals for M3.

5 screws. 7.2mm max. 7.2mm max. J Wiring F Power supply 10 9 8 7 6 5 4 3 2 1 30 31 32 29 28 27 26 25 24 23 22 21 33 20 19 18 17 16 15 14 13 12 11 In the following wiring diagrams, the left side of the terminal Nos. indicates the inside of the controller. · Input power to terminals Nos. 9 and 10. Power specifications are as follows: 100 to 240 VAC, 50/60 Hz, approx.

16 VA or 24 VAC, 50/60 Hz, approx. 12 VA 24 VDC, 8W 2--8 2.3 Wiring Terminals F Sensor input 10 9 8 7 6 5 4 3 2 1 30 31 32 29 28 27 26 25 24 23 22 21 33 20 19 18 17 16 15 14 13 12 11 · Connect the sensor input to terminal Nos. 11 to 14 and 33 as follows according to the input type. 14 13 12 11 33 + 14 13 12 11 33 Platinum resistance thermometer 14 13 12 11 33 + V - 14 13 12 - 11 mA Current input Thermocouple Voltage input 33 + F Control output 10 9 8 7 6 5 4 3 2 1 30 31 32 29 28 27 26 25 24 23 22 21 33 20 19 18 17 16 15 14 13 12 11 · Terminal Nos.

7 and 8 are for control output 1 (OUT1), and terminal Nos. 5 and 6 are for control output 2 (OUT2). The following diagrams show the available output units and their internal equalizing circuits. 86 75 Relay E53-R + L V 86 75 SSR E53-S + +v 86 + L +v 86 + L GND 75NPN E53-Q E53-Q3 GND 75PNP E53-Q4 86 mA 86 L 75 4 to 20mA/0 to 20mA E53-C3 E53-C3D 750 to 10V/0 to 5V E53-V34 E53-V35 · With E53-Vjj output units, about 2 V is output for one second after the power is interrupted. · The following table shows the specifications for each output unit.

Model E53-R E53-S E53-Q E53-Q3 E53-Q4 E53-C3 E53-C3D E53-V34 E53-V35 Output Type Relay SSR Voltage (NPN) Voltage (NPN) Voltage (PNP) 4 to 20 mA 0 to 20 mA 0 to 10 V 0 to 5 V Output Mode Pulse Pulse Pulse Pulse Pulse Linear Linear Linear Linear 250 VAC, 5 A 75 to 250 VAC, 1 A Specifications NPN : 12 VDC, 40 mA (with short-circuit protection) NPN : 24 VDC, 20 mA (with short-circuit protection) PNP : 24 VDC, 20 mA (with short-circuit protection) 4 to 20 mA, Permissible load impedance: 600 max., Resolution: Approx. 2600 0 to 20 mA, Permissible load impedance: 600 max., Resolution: Approx. 2600 0 to 10 VDC, Permissible load impedance: 1 k min., Resolution: Approx. 2600 0 to 5 VDC, Permissible load impedance: 1 k min., Resolution: Approx. 2600 · With E5AK-TPRR2 controllers, relay output (250 VAC, 1A) is fixed. When the output unit is replaced, use the E53-R.

The following diagrams show the relationship between terminals and open/close relay terminal settings. 8 7 Open 6 5 Close 2--9 CHAPTER 2 PREPARATIONS F Auxiliary output 10 9 8 7 6 5 4 3 2 1 30 31 32 29 28 27 26 25 24 23 22 21 33 20 19 18 17 16 15 14 13 12 11 · Terminal Nos.3 and 4 are for auxiliary output 1 (SUB1) and terminal Nos.1 and 2 are for auxiliary output 2 (SUB2). · The internal equalizing circuits for the auxiliary outputs are as follows: 4 3 Auxiliary output 1 2 1 Auxiliary output 2 · Output specifications are as follows: SPST-NO, 250 VAC, 3 A · When the HBA function on an E5AK-TAA2 controller is used, connect CT input (CT) to terminal Nos.15 and 17. When monitoring the valve opening on an E5AK-TPRR2 controller, connect the potentiometer (PTMR) to terminal Nos.15 to 17. Connect each of these inputs as follows: 17 16 15 CT input CT 17 16 15 O W C F CT input/Potentiometer 10 9 8 7 6 5 4 3 2 1 30 31 32 29 28 27 26 25 24 23 22 21 33 20 19 18 17 16 15 14 13 12 11 Potentiometer · For details on CT inputs, see Appendix, About Current Transformer (CT) Input (page A-5). · For details on the potentiometer, see the Instruction Manual for the valve connected to the controller.

The meaning of terminal symbols is as follows: O: OPEN, W: WIPE, C: CLOSE The variable resistance range is 100 to 2.5 k. About Isolation The E5AK-T has independent power supplies for each of the terminal blocks shown on the right. B A 10 9 8 7 6 5 4 3 2 1 B 30 31 32 29 28 27 26 25 24 23 22 21 33 20 19 18 17 16 15 14 13 12 11 C C E F D 2--10 2.3 Wiring Terminals F Event input 10 9 8 7 6 5 4 3 2 1 30 31 32 29 28 27 26 25 24 23 22 21 33 20 19 18 17 16 15 14 13 12 11 · Connect event inputs 1 and 2 (EV1/2) to terminal Nos.

18 to 20, and event events 3 and 4 (EV3/4) to terminal Nos.24 to 26. However, note that terminal Nos.18 to 20 cannot be used on controllers supporting the communications function. · Connect the event inputs as follows: EV1 EV2 20 19 + + EV3 EV4 26 25 + + COM 18 COM 24 Event input 3 and 4 Event input 1 and 2 Terminal Nos.

18 and 24 (COM) are connected internally. · Use event inputs under the following conditions: Contact input No-contact input ON: 1 k max., OFF: 100 k min. ON: residual voltage 1.5 V max., OFF: leakage current 0.1 mA max. · Polarities during no-contact input are as follows: EV1 EV2 20 19 + + EV3 EV4 26 25 + + COM 18 Event input 1 and 2 COM 24 Event input 3 and 4 F Transfer output · Connect transfer output (TRSF) to terminal Nos. 29 and 30. · The internal equalizing circuit for transfer output is as follows: 30 4 to 20mA 29 + L · Transfer output specifications are as follows: 4 to 20 mA DC, Permissible load impedance: 600 max.

, Resolution: Approx. 2600 F Communications · Terminal Nos.18 to 20, 31 and 32 can be used only on controllers that support the communications units (E53-AK01/02/03). · For details on wiring, see Chapter 6, Using the Communications Function. 2--11 CHAPTER 2 PREPARATIONS 2--12 CHAPTER 3 BASIC OPERATION CHAPTER3 CHAPTER 3 BASIC OPERATION This chapter describes actual examples for understanding the basic operation of the E5AK-T. 3.1 Convention Used in this Chapter

. . . . 3.
2 Setting Input Specifications
. Input type . .
.
.
. Temperature input . . .
.
.
. Analog input . .
.
.
. 3.
3 Setting Output Specifications
. Output assignments
.
.
. Direct/reverse operation

.....

.. Control period

.....

.....

..... 3.4 Setting Alarm Type ..

.....

.....

... Alarm type ..

.....

.....

.....

. Alarm value

.....

.....

... Alarm hysteresis ..

.....

.....

..... Close in alarm/open in alarm

.....

... 3.5 Setting Patterns .

.....

.....

.. Pattern No. ...

.....

.....

.....

. Number of steps

.....

.....

.... Step SP/Step time

.....

.....

..... Alarm value

.....

.....

.....

... 3.6 Protect Mode

.....

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Security

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. Key protect

.....

.....

..... 3.

7 Starting and Stopping Operation 3.8 Adjusting Control Operation .

.....

. Changing currently running programs ... Manual operation .

.....

.....

..... Auto-tuning (A.T.) ..

.....

.....

..... 3-2 3-4 3-4 3-5 3-5 3-7 3-7 3-8 3-8 3-10 3-10 3-10 3-11 3-11 3-14 3-15 3-15 3-15 3-16 3-19 3-19 3-19 3-21 3-22 3-22 3-24 3-25 3--1 CHAPTER 3
BASIC OPERATION 3.



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I Convention Used in this Chapter This chapter describes basic E5AK-T operations such as how to set up parameters, start and stop operation, and adjust control operation. For more complex control examples, refer to Chapter 4 Applied Operation and Chapter 5 Parameters. F Basic Operation Flow The following diagram shows the basic flow of operation. Power ON Setup Setting input specifications Setting output specifications Setting alarm output Setting patterns Protecting parameters Operation Start Adjustment Stop Power OFF The descriptions in this chapter follow the order of basic operations shown in the flow above. Examples of operation of each of the items are described up to completion of parameter setup. However, you must move to the top parameter of the following setting. For example, when you have finished "setting input specifications" and you want to "set output specifications," move to the top parameter of "setting output specifications" from the bottom parameter of "setting input specifications." For details on moving to parameters between items, refer Chapter, Selecting modes and Selecting parameters (page 1-10).

3--2 3.1 Convention Used in this Chapter F Setup examples This description assumes that the controller is operated under the following conditions.

- A K thermocouple is used as the input.
- Control output (heat), alarm 1 and alarm 2 functions are assigned to "control output 1," "control output 2" and auxiliary output 1, respectively. Of these, only control output 1 and auxiliary output 1 are used.
- The relay output unit is mounted at control output 1.
- The upper-limit alarm is set as alarm 2.

The alarm is output when the temperature exceeds 10_C with respect to the PV.

- The program is made up of one pattern comprising four steps.
- The following figures show terminal wiring and the program used in the setting examples. Temperature sensor: K thermocouple Control target AC100-240V 10 9 OUT1 8 7 6 5 Alarm 2 (upper limit) (alarm value=10°C) SUB1 4 3 2 1 29 27 26 25 24 23 22 21 33 30 31 32 20 19 28 18 17 16 15 14 13 12 11 4 to 20mA

E5AK-TAAjj (Control output 1: E53-R) SP 100 Step 1 Step 2 + Step 3 Pattern 0 50 0.20 0.

40 0.20 Time: hr, min 3--3 CHAPTER 3 BASIC OPERATION 3.2 Setting Input Specifications Setting input specifications Input type N Setup mode Temperature input? Y Temperature unit Scaling Decimal point Temperature input shift Level 2 mode End of setup

- With temperature input, scaling and decimal point parameters need not be set as this information is determined by the input (sensor) type. (These parameters are not displayed.) Note that temperature unit and temperature input shift parameters need to be set.
- With analog input, the "scaling upper limit", "scaling lower limit" and "decimal point" parameters need to be set.
- J Input type
- Set the type No. (0 to 21) in the "input type" parameter (Set up mode). The factory setting is "2: K1 (thermocouple)."
- For details on input types and setting ranges, see page 5-31.

3--4 3.2 Setting Input Specifications J Temperature input F Temperature unit

- To switch the temperature unit from "_C" to "_F" when input is temperature, switch the "_C/_F selection" parameter (setup mode) from "" to "".
- F Temperature input shift
- When input is temperature input, the upper and lower limit values of the sensor can be shifted linearly. For example, if both the upper and lower limit values are shifted by 1.2_C, the process value (before shift) is regarded as 201.2_C after shift when input is 200_C before shift.
- To set input shift, set shift values in the "input shift upper limit" and "input shift lower limit" parameters (level 2 mode).
- Temperature Input shift upper limit value Upper limit value After shift Before shift Lower limit value 0 Input shift lower limit value Input (%FS) 100 J Analog input
- When the analog input (the voltage input and current input) is selected, scaling matched to the control is required.
- The "scaling upper limit", "scaling lower limit" and "decimal point" parameters (setup mode) are used for scaling. These parameters cannot be used when the temperature input type is selected.

- The "scaling upper limit" parameter sets the physical quantity to be expressed by the upper limit value of input, and the "scaling lower limit" parameter sets the physical quantity to be expressed by the lower limit value of input. The "decimal point" parameter sets the number of digits past the decimal point.
- The following figure shows a scaling example of 4 to 20 mA input. After scaling, the humidity can be directly read. In this case, the "decimal point" parameter is set to "1".

Readout (humidity) Scaling upper limit value (95.0%) Scaling lower limit value (10.0%) 0 Input (4 to 20 mA) 100%FS 3--5 CHAPTER 3 BASIC OPERATION Setting Example In this example, let's check the input type and temperature units, and shift the lower limit by 1_C and the upper limit by 3_C. "input type" = "2: K1" "temperature unit" = "_C" "input shift upper limit" = "3.0" "input shift lower limit" = "1.

0" 1 second min. (1) Select the menu display, and select ": setup mode" using the or keys. For details on selecting the menu display, see page 1-10. key for one second minimum to enter the setup (2) Press the : input type" is mode. The top parameter in the setup mode " displayed. This parameter is factory-set to "2: K1". key to fix the set value. The display changes to (3) Press the : _C/_F selection" parameter. This parameter is factory-set " to " : _C". (4) Select the menu display, and select " or keys.

: level 2 mode" using the 1 second min. key for one second minimum to enter the level 2 (5) Press the mode. The top parameter in the level 2 mode [] ("local/remote" parameter) is displayed. 1 second min. key until [] ("input shift upper limit" parame(6) Press the ter) is selected. This parameter is factory-set to "0.0". (7) Press the key until "3.0" is displayed. key until [] ("input shift lower limit" parame(8) Press the ter) is selected.

This parameter is factory-set to "0.0". key until "1.0" is displayed. This sets the "input shift (9) Press the upper limit" and "input shift lower limit" values.

3--6 3.3 Setting Output Specifications 3.3 Setting Output Specifications Some output specifications are different according to controller type, standard or position-proportional.



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Default is "2: Upper-limit alarm (deviation)". J Alarm value · Alarm values are indicated by "X" in the table above.

Alarm output operation differs according to whether the value of the alarm is positive or negative. · Alarm values are built into the program and are set for each pattern. For details, see 3.5 Setting Patterns" (page 3-14). 3--10 3.4 Setting Alarm Type J Alarm hysteresis · The hysteresis of alarm outputs when alarms are switched ON/OFF can be set as follows: Upper limit alarm Lower limit alarm Alarm hysteresis ON ON Alarm hysteresis OFF Alarm value OFF Alarm value · Alarm hysteresis is set independently for each alarm in the "alarm 1 to 3 hysteresis" parameters (level 2 mode). Default is "0.02: 0.02%FS". F Standby sequence · "Standby sequence" is a function for unconditionally turning alarm output OFF when the process value has left the alarm range once and it next enters the alarm range.

· For example, when the alarm type is set to " lower-limit alarm," generally the process value is within the alarm range, and alarm output smaller than the set point, and alarm output becomes ON when this state continues. However, if the alarm type is set to " lower-limit alarm with standby sequence", alarm output first becomes ON when the process value exceeds the alarm setting value to leave the alarm range and once again falls below the alarm value. · The standby sequence is canceled when an alarm is output. It is, however, restarted later by one of the following conditions: Operation is started or power is turned ON. A pattern is started. The program advances to the next step. The SP of the current step is changed. The currently running alarm value is changed. The input shift value is changed. Advance is executed.

J Close in alarm/open in alarm · When the controller is set to "close in alarm," the status of the alarm output function is output as it is. When set to "open in alarm," the status of the alarm output function is output inverted. Alarm ON OFF ON OFF Output ON OFF OFF ON Output LED Lit Not lit Lit Not lit Close in alarm Open in alarm · Alarm type and close in alarm (normally open)/open in alarm (normally close) can be set independently for each alarm. · Close in alarm/open in alarm is set in the "alarm 1 to 3 open in : close in alarm". alarm" parameters (setup mode).

Default is " 3--11 CHAPTER 3 BASIC OPERATION F Summary of alarm operations The figure below visually summarizes the above descriptions of alarm operations (when alarm type is set to "lower-limit alarm with standby sequence"): Alarm type: lower limit alarm with standby sequence PV Alarm value Alarm hysteresis Time Standby sequence canceled Alarm output ON OFF ON (closed) OFF (open) 3--12 3.4 Setting Alarm Type Setting Example Alarm 2 is output when the temperature exceeds alarm value 2 programmed to the SP Parameter factory settings for "alarm type 2,". "alarm hysteresis" and "close in alarm/open in alarm" are used. In this example, the related parameters are set as follows: "alarm type 2" = "2: upper-limit" "alarm value 2" = (set in program setting) "alarm hysteresis: = "0.02" : close in alarm" "close in alarm/open in alarm" = " In this example, let's check the alarm type. 1 second min. (1) Select the menu display, and select " : setup mode" pressing or keys. For details on selecting the menu display, see the page 1-9. key to enter the setup mode. The top parameter in (2) Press the : input type" is displayed. the setup mode " key until [] ("alarm type 2" parameter) is displayed. (3) Press the played. Default is "2: upper limit". 1 second min. 1 second min. 3--13 CHAPTER 3 BASIC OPERATION 3.

5 Setting Patterns If you want to set parameters in the program mode during controller operation, you must first stop operation. Operation may continue only in special instances, for example, to change SP during controller operation. · Parameters that you use frequently for programming can be set in the "program mode." The flow below shows the parameters that are available in the program mode and the order in which they are set. Select the program mode. Select pattern No. Set number of steps Rate of rise setting Step time/Rate of rise programming Step time setting Set step SP/step time Set SP/Ramp time /Soak time of each step Set pattern execution count Set alarm value Set time signal 1, 2 Step/ON time/OFF time n All patterns completed? y End of program This chapter describes the basic operation of programming. For details on the following parameters, refer to Chapter 4 Applied Operation: "Step time/Rate of rise programming", "Pattern execution count", "Time signal 1, 2" 3--14 3.5 Setting Patterns J Pattern No. · This parameter cannot be changed during controller operation.

· Set the desired pattern No. Step SP step time, alarms and other parameters that follow this parameter are set for the pattern that is set in this parameter. · Set within the range 0 to 7 (pattern 0 to 7). Default is "0". J Number of steps · Set the number of steps for the pattern that you specified in the "pattern No." parameter. · Set within the range 1 to 16 (step). Default is "8". · Set only the number of steps used in the program in order from step 0, as "step 0 SP", "step 0 time", "step 1 SP", "step 1 time" and so forth. · Set within the range from set point lower limit to set point upper limit for step SP Default is "0". · Set within the range 0.00 to 99.59 (hours:minutes or minutes:seconds). Default is "0.00". SP Step 0 Step 1 Step 2 Step 3 J Step SP/Step time : : : 0 to 15 B A Step 0 time Step 1 time Step 2 time Step 3 time A: SP of steps 0 and 3 B: SP of steps 1 and 2 Time · As shown in the above figure, step 0 is a fixed value, so when ramp operation is started, set the "step 0 time" parameter to "0.00" to configure the program so that ramp operation starts from step 1. 3--15 CHAPTER 3 BASIC OPERATION J Alarm value : : : 0 to 3 · Alarm values can be set only for alarms that have been assigned as output. · When a deviation alarm is assigned as output, the alarm value is set with respect to SP The following example shows the relationship be.

tween the SP and alarm value when the alarm type is set to "upper limit." SP Step 0 Step 1 Step 2 Step 1 SP Step 0 SP Alarm value Alarm type: upper-limit alarm Time About the Alarm Value Decimal Point 3--16 The decimal point of the alarm value conforms to the setting of the "decimal point" parameter.



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