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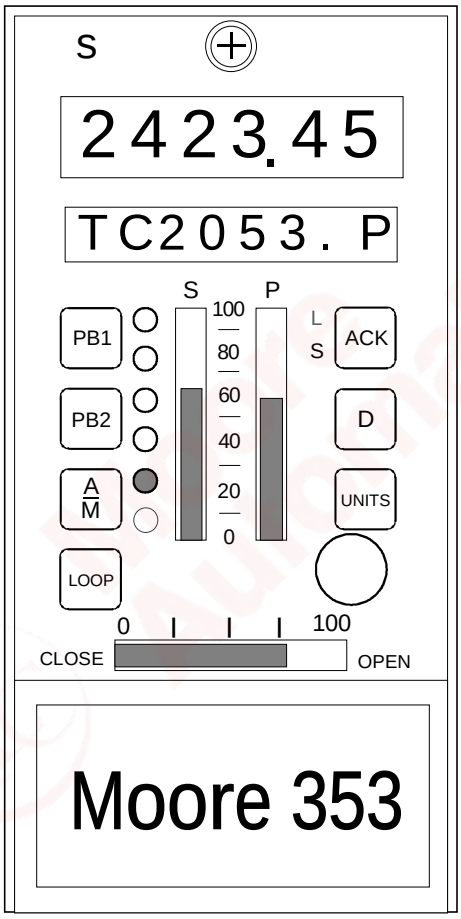
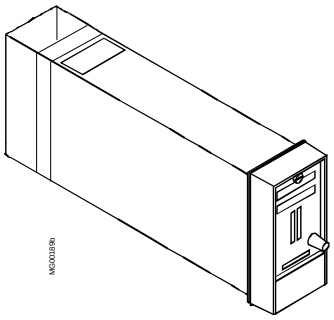
Siemens Energy & Automation	**USER'S MANUAL**

UM353-1
Rev. 11
March 2003
Supersedes Rev. 10



PROCESS AUTOMATION CONTROLLER

1.0 INTRODUCTION



This User's Manual contains configuration, installation and service information for the Moore 353™ Process Automation Controller. It is divided into fifteen sections.

- Section 1, Introduction, has general information about the organization of this manual, the controller, product support, and the contents of a typical shipment.
- Section 2, Configuration Overview, contains a list of the functions blocks available for use in configuring the controller and a procedure for configuration. Function block availability depends on controller model and MPU Controller board firmware version.
- Section 3, Function Blocks, contains a detailed description of each function block.
- Section 4, Factory Configured Options, provides a graphical presentation of the function blocks used in FCOs and a listing of changes made to default function block parameters.
- Section 5, LonWorks Communications, provides an overview of LonWorks® communication.
- Section 6, Network Communications, furnishes overviews of Modbus, LIL, and Ethernet communication data.
- Section 7, Data Mapping, contains network data details for Modbus, Local Instrument Link (LIL), and Ethernet.
- Section 8, Installation, contains drawings and steps detailing mechanical and electrical installation. Electrical connections to the controller are identified and numerous wiring diagrams are included.
- Section 9, Local Faceplate Operation, describes and illustrates the Display Assembly's operator controls and displays. Use of these for on-line operation, for configurations and for autotuning is described.
- Section 10, Controller and System Test, has procedures for testing the controller and the installation.
- Section 11, Maintenance, lists the tools and test equipment to service a controller. It also has preventive maintenance and servicing procedures, including error codes. Assembly replacement steps are included as are detailed jumper selection criteria and jumper setting steps.
- Section 12, Calibration, provides step-by-step procedures for calibration of analog input and output circuits.
- Section 13, Circuit Description, furnishes a block diagram level description of the controller's circuits.
- Section 14, Model Designation and Specifications, shows controller model numbers; a list of accessories; mechanical, electrical, and environmental specifications; and a list of current agency approvals.
- Section 15, Abbreviations and Acronyms, is a convenient reference for new users that explains many abbreviations and acronyms appearing in this manual.

IMPORTANT

Save this User's Manual. It should be available to those installing, configuring, operating, and servicing the controller.

1.1 PRODUCT DESCRIPTION

The Moore 353 offers the control system designer the ultimate in flexibility and capability for the implementation of continuous solutions and batch solutions. An exploded view of the controller appears in Figure 1-1.

At the heart of the Moore 353 is a powerful MPU Controller board that uses the latest in microprocessor technology. It includes on-board I/O and reusable function blocks, and it is capable of solving a vast array of control implementations including single loop, cascade, and dual loop. Available MPU board I/O is listed in the table below.

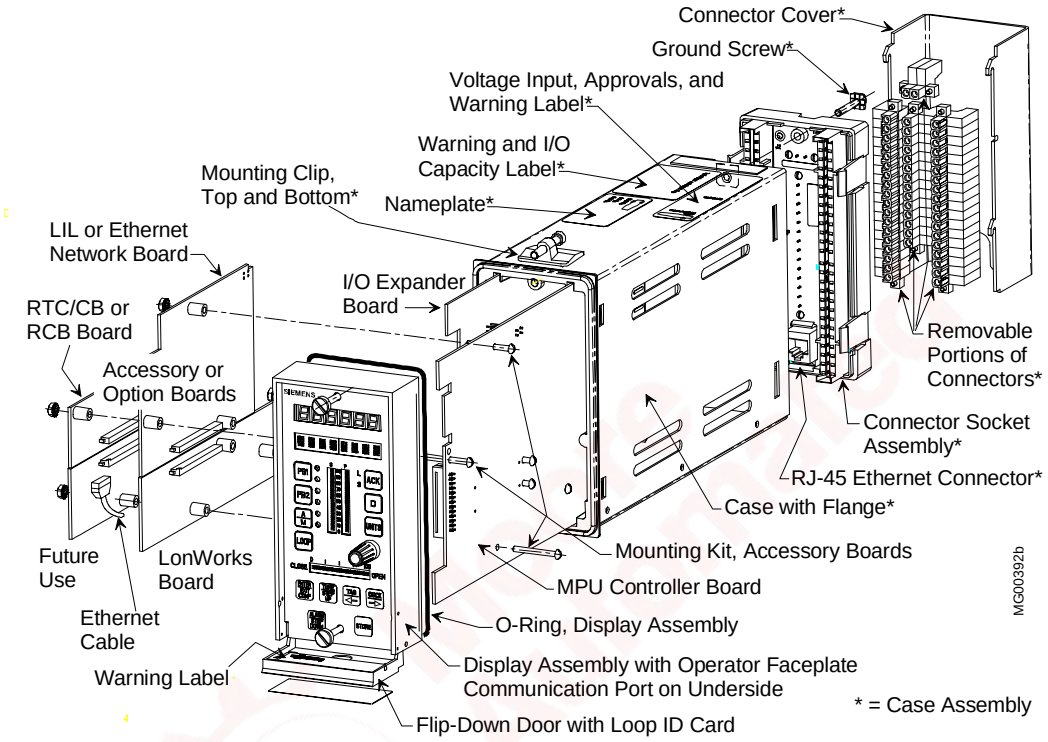


FIGURE 1-1 Moore 353, Exploded View

Modbus communication is standard and a port (RS485, half-duplex) at the rear terminals provides for network connection of up to 32 controllers (e.g. Models 352P, 353, 354, 354N, and Procidia™ i|pac™) to an operator workstation, Human/Machine Interface (HMI), or DCS, enabling integration of controllers into a plant-wide system. A popular HMI is the Procidia i|station™ running i|ware PC™ operator interface software. A communication port (RS232) on the underside of the Display Assembly is available for configuration and/or debugging when using i|config™, the optional PC-based Graphical Configuration Utility.

An optional I/O Expander Board can be added to the base Moore 353. It includes direct thermocouple, RTD, and frequency inputs and additional I/O for direct process measurement of temperature and frequency variables, improving accuracy and control. Available Expander board I/O is listed below.

I/O on MPU Controller Board	I/O on Expander Board
Analog Inputs 1, 2, and 3	Analog Input 4
Analog Outputs 1 and 2	Analog Output 3
Digital Inputs 1 and 2	Digital Inputs 3 and 4
Digital Outputs 1 and 2	---
---	Analog Inputs Universal 1 and 2
---	Digital Inputs Universal 1 and 2
---	Relay Outputs 1 and 2

When even more I/O is needed for multiple-loop applications, advanced control, or batch sequencing, a remote I/O option board that uses the popular LonWorks protocol can be installed. This LonWorks board provides connectivity via a high-speed digital fieldbus to a large selection of standard I/O products: analog inputs and outputs and digital inputs and outputs using relay or solid state technology.

Although the Moore 353 can be connected to and operated entirely from a central operator workstation, such as i|station, a controller faceplate is included. This local operator interface is for applications where loops need individual attention during startup, troubleshooting, maintenance, or emergency conditions. The convenient faceplate layout and sophisticated software allow process and configuration changes to be made quickly and easily.

The controller can be completely configured from the operator faceplate or, as mentioned above, configured remotely using i|config™, the optional PC-based Graphical Configuration Utility. An optional Real Time Clock/Configuration Board (RTC/CB) is available to quickly transfer a configuration from one controller to another when downloading a configuration over a network is not available. The RTC/CB also provides a real time clock function.

Network communication options are listed in the following table.

Protocol (Select One)	Available	Connection	Option Board Needed
Modbus	Standard	Rear Terminals, NCA and NCB	None
Local Instrument Link	Optional	Rear Terminals, NCA and NCB	LIL Communication
Ethernet	Optional	Rear Panel, RJ-45 (requires case option 4)	Ethernet Communications

Modbus communication is standard. An optional Local Instrument Link (LIL) network board is available in place of the Modbus communication to provide higher speed networking and peer-to-peer communication between controllers. This provides connectivity with an array of network-enabled products, including those listed below.

Current Controller Models	Previous Controller Models
Procidia i|pac Internet Control System Moore 352P Single-Loop Digital Controller	Model 352 Single-Loop Digital Controller Model 351 Triple-Loop Digital Controller Moore 354/354N Universal Controllers Model 382 Logic and Sequence Controller

An optional Ethernet board is available in place of Modbus and LIL communication. This option enables peer-to-peer communication between Moore 353 controllers, Procidia i|pac controllers, and many other devices that feature Ethernet (embedded Modbus RTU protocol). Ethernet communications requires an Ethernet board and controller firmware V2.4 or higher.

The Ethernet board supports uploading and downloading of controller configurations over the Ethernet LAN. For example, if i|config Graphical Configuration Utility software is loaded on the local client shown in Figure 1-2, controller configurations can be developed on the client, or uploaded from the controller for editing, and then downloaded to the controller. Data can also be acquired from remote servers for the purpose of archiving and/or data mining. The Ethernet-Modbus Bridge in Figure 1-2 accepts an Ethernet data command from the controller and outputs an equivalent Modbus command to a Modbus device at address 1. The returning Modbus data is embedded by the bridge in an Ethernet packet to be sent to the requesting controller.

Regardless of the selected communication option, the RS232 port on the underside of the Display Assembly will communicate using Modbus. Controller hardware architecture is designed to accommodate other emerging fieldbus technologies. This includes field communications that require lower power for intrinsic safety and higher speed for interplant networking.

For small retrofit applications, the Moore 353 with operator faceplate is a replacement for a simple stand-alone single-loop controller. It is easily upgraded with additional I/O and communication options for advanced control strategies and plant networking.

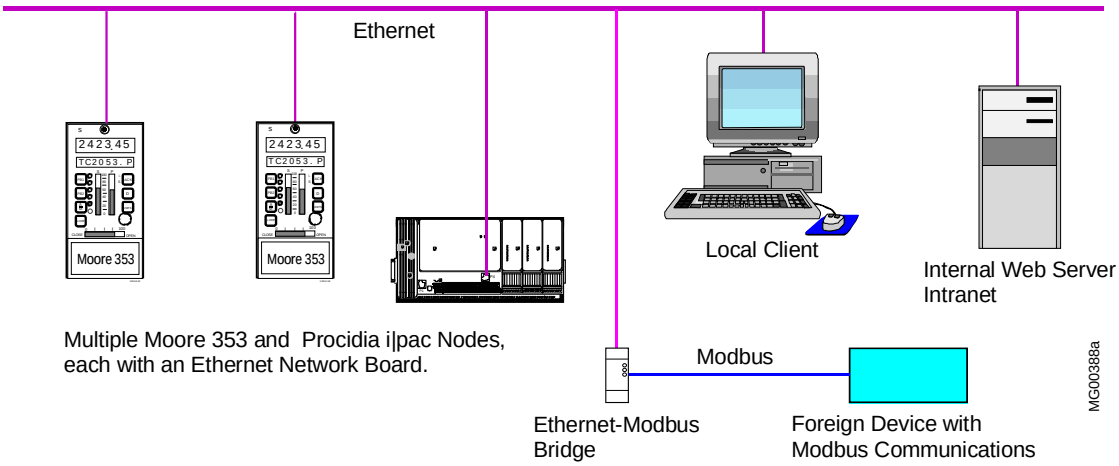


FIGURE 1-2 Ethernet Architecture Example

Often in this publication, reference is made to the labels on the controller to ensure that the controller being installed has the correct power input, I/O, communication options, and approvals. This is particularly important when non-incendive requirements are present or a critical process is involved where a custom configuration or calibration has been created. Label locations are shown in Figure 1-1 and typical labels are shown in Section 14 Model Designation and Specifications.

1.2 FUNCTION BLOCKS

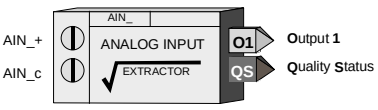
Controller software is built on proven function block designs from previous LIL products and from Siemens APACS® products that support the IEC1131 standard. In many cases, the controller has been enhanced with features only now possible with state of the art technology.

Function blocks are selected for use within a LOOP. Multiple loops can be configured, and each loop can be associated with an operator faceplate. Certain blocks are used once within each loop (e.g. controller, setpoint, auto/manual), others can be used as many times as needed. Some notable features include Auto Tuning within the PID function blocks, an expandable Sequencer that allows configuration of up to 250 steps, and up to 256 discrete inputs and outputs. In addition, the Graphical Configuration Utility can be used to design the logic in a ladder diagram. Combining these features with continuous control loops within the same controller offers a well-integrated solution for small batch operations.

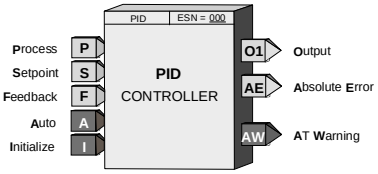
Several function blocks are available at the station level for configuration of STATION level parameters, such as the station address and station tag name. Function blocks include the CLOCK block (when the RTC/CB option board has been included), and the ETHERNET block (when the Ethernet board has been installed and the controller contains firmware V2.4 or higher) to configure parameters such as the IP address. All other function blocks are used for configuration within an individual LOOP. Control implementations are configured in the Moore 353 by first creating a loop, then entering a unique loop tag name and selecting function blocks for use within that loop. A number of loops can be configured in the Moore 353 and a number of function block types are available as described in the sections that follow.

1.2.1 LOOP Function Block Types

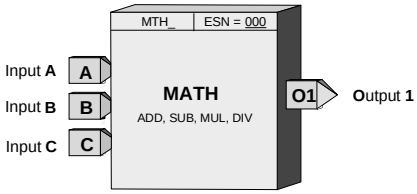
Local I/O Function Blocks are provided on both the MPU Controller Board and the I/O Expander Board. These blocks can be used in any LOOP, but as fixed resources are expendable. When used within a loop, the unique block name becomes <loop>.<block> (e.g. TC2053.AIN1 for Analog Input 1 used in loop TC2053).



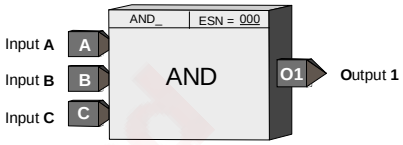
Fixed Loop Function Blocks can be selected for use within each configured LOOP and include those blocks which define the major functions of a loop. The operator display function block (e.g. ODC Operator Display for Controllers) defines the loop type, the function of the local faceplate as well as the processing of commands coming from a remote workstation. A single controller function block can be selected from one of five available choices (ID, ON_OFF, PD, PIDAG, & PID) within each loop. When used within a loop the unique block name becomes <loop>.<block> (e.g. TC2053.PID for the PID controller used in loop TC2053).



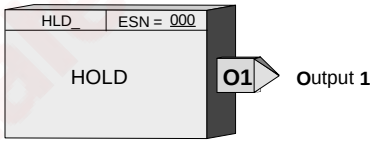
Arithmetic Function Blocks are also designated as LOOP function blocks and can be used as many times as needed in each loop. Each use of a block is automatically assigned a unique name (i.e. MATH01, MATH02) within each loop so that the unique block name becomes <loop>.<block> (e.g. TC2053.MATH01).



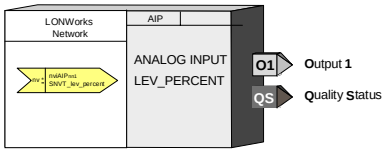
Logic Function Blocks are also designated as LOOP function blocks and can be used as many times as needed in each loop. Each use of a block is automatically assigned a unique name (i.e. AND01, AND02) within each loop so that the unique block name becomes <loop>.<block> (e.g. TC2053.AND01).



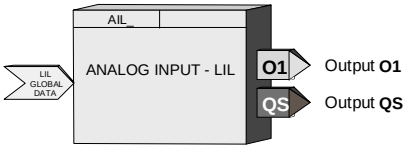
General Purpose Function Blocks are also designated as LOOP function blocks and include blocks that do not fall into the arithmetic or logic categories. These can be used as many times as needed and each use will automatically be assigned a unique name (e.g. HLD01, HLD02) within each loop so that the unique block name becomes <loop>.<block> (e.g. TC2053.HLD01).



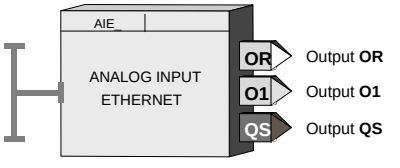
Remote I/O Bus Function Blocks can be used as needed in each LOOP (when the LonWorks option is installed) to provide a method for sending and receiving both analog and discrete data to and from remote devices over the remote I/O digital bus. Each use will automatically be assigned a unique name (e.g. AIP01, AOP01) within the station so that the unique block name becomes <loop>.<block> (e.g. TC2053.AIP01 for Analog Input-lev_Percent used in loop TC2053). The second AIP block used within the station will be assigned AIP02 even if in a different loop so that the remote I/O blocks have unique names within the station. This will enable unique names for station variables on the LON network.



LIL Global Function Blocks are used as needed within a LOOP when the LIL option board is installed to enable global data communication over the LIL. They will automatically be assigned a unique name (e.g. AIL01, DIL01) within each loop when it is configured so that the unique block name becomes <loop>.<block> (e.g. TC2053.AIL01). Input and output data blocks are available as needed and will be assigned unique names as used (e.g. AIL01, AIL02 for Analog Input-LIL blocks).



Ethernet Function Blocks (V2.4) are used as needed within a LOOP when the Ethernet option board is installed They will automatically be assigned a unique name (e.g. AIE01, DIE01) within each loop when it is configured so that the unique block name becomes <loop>.<block> (e.g. TC2053.AIE01).



1.2.2 Power Up Initialization

The Moore 353 will retain, in the station NVRAM, calculated block values (e.g. outputs, elapsed time, last input/output logic states), including the time since power was lost. Three power up modes (hot, warm, and cold) are utilized in the Moore 353 that affect the initialization of function blocks. These modes are configured by two power up timers (warm and cold), included in STATION parameters. The station will initialize a hot start when power up occurs prior to the expiration of the warm timer. A cold start will occur when power up occurs after the expiration of the cold timer and a warm start will take place when the station powers up after the expiration of the warm timer but prior to the expiration of the cold timer.

Hot Start[1] - All function block execution continues from the last state prior to power fail.

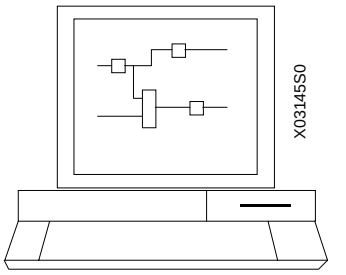
Warm Start[1] - Function blocks that have a power up in a last state feature, either by design or by configuration selection, will power up as defined in the individual block descriptions. All other function blocks will initialize at cold start conditions.

Cold Start[1] - All function block outputs will initialize at 0 unless otherwise stated in individual block descriptions.

1.2.3 Configuration

The Moore 353 can be configured either locally or remotely. First, the local faceplate includes buttons located behind a flip-down door for complete configuration including the addition/deletion of loops and function blocks and the editing of function block parameters. Section 2 Configuration Overview includes a road map for stepping through configuration. Certain block parameters (e.g. gains, constants) can be edited while on-line but design changes (e.g. block interconnections, block additions) will put the station in "configuration hold" which will hold outputs at the current value until the Exit button is pressed. This will enable bumpless changes to be made while on-line.

The second method is to use the Graphical Configuration program. A configuration can be downloaded to a controller either via the port on the local faceplate or over a network (either Modbus, Ethernet, or LIL). During a download, all outputs will be held and the controller will retain all the intermediate calculations of all the blocks it had been running prior to the download. After the download, all function block parameters with the same tag name as those held will be used to initialize the downloaded function block parameters, thus providing a bumpless download under these conditions. If a loop tag name is changed, the tag names of all function blocks within that loop will change and will, therefore, require re-initialization of all of these blocks. However, the loop tag can be changed from the local faceplate without causing re-initialization, providing a bumpless tag change.



Optional PC-Based
Graphical Configuration Software

1.3 PRODUCT SUPPORT

Product support can be obtained from a customer service center (i.e. Technical Support Group in North America or a Technical Information Center (TIC) in Asia or Europe). Each region has a customer service center that provides direct telephone support on technical issues related to the functionality, application, and integration of the product. Regional contact information is provided below. Your regional Technical Support Group or TIC is the first place to call when seeking product support information. When calling, it is helpful to have the following information ready:

- Product part number or model number and version
- If there is a problem with product operation:
  - Whether or not the problem is intermittent
  - The steps performed before the problem occurred
  - Any status message, error messages, or LED indications displayed
  - Installation environment

[1] *Set the Real Time Clock Jumper (W7 or W8) on the MPU Controller board. Refer to Section 9 Maintenance for details.*

The Siemens public Internet site has current revisions of technical literature, in Portable Document Format, for downloading.

TABLE 1.1 Contact Information

NORTH AMERICA	Telephone	+1 215 646 7400, extension 4993
	Fax	+1 215 283 6358
	E-mail	MandCTechSupp@sea.siemens.com
	Hours of Operation	8 a.m. to 6 p.m. eastern time Monday – Friday (except holidays)
	Public Internet Site	www.sea.siemens.com/ia/
	Repair Service	+1 215 646 7400 extension 4993

ASIA	Telephone	+011 65 299 6051
	Fax	+011 65 299 6053
	E-mail	TICGroupAP@sea.siemens.com
	Hours of Operation	9 a.m. to 6 p.m. Singapore time Monday – Friday (except holidays)
	Public Internet Site	www.sea.siemens.com/ia/
	Repair Service	+011 65 299 6051

EUROPE	Telephone	+44 (0) 1935 470172
	Fax	+44 (0) 1935 470137
	E-mail	TICGroupEurope@sea.siemens.com
	Hours of Operation	8:30 a.m. to 4:30 p.m. GMT/BST Monday – Friday (except holidays)
	Public Internet Site	www.sea.siemens.com/ia/
	Repair Service	+44 (0) 1935 470172

1.4 EQUIPMENT DELIVERY AND HANDLING

1.4.1 Factory Shipment

Prior to shipment, a controller is fully tested and inspected to ensure proper operation. It is then packaged for shipment. Most accessories are shipped separately.

1.4.2 Receipt of Shipment

Inspect each carton at the time of delivery for possible external damage. Any visible damage should be immediately recorded on the carrier's copy of the delivery slip.

Carefully unpack each carton and check the contents against the enclosed packing list. Inspect each item for any hidden damage that may or may not have been accompanied by exterior carton damage.

If it is found that some items have been damaged or are missing, notify the Process Instrumentation Division of Siemens Energy and Automation immediately and provide full details. In addition, damages must be reported to the carrier with a request for their on-site inspection of the damaged item and its shipping carton.

1.4.3 Storage

If a controller is to be stored for a period prior to installation, review the environmental specifications in Section 14 Model Designation and Specifications.

As shipped, the MPU Controller board Real Time Clock Jumper (W7 or W8) is set to maximize battery life. If the jumper has been set to enable Hot/Warm Start, or to confirm that the jumper is properly set, refer to Section 11 Maintenance and set the jumper for storage.

1.4.4 Typical Shipment Contents

The items listed below are those typically included in a shipment and are subject to change.

1. Moore 353 Process Automation Controller, model number per order, qty. 1
2. Power Input and Range Resistor Kit, PN 16354-30, qty. 1

DESCRIPTION	QUANTITY
Resistor, 250Ω, 0.1%, 3W, WW	3
Sleeving	3
Crimp-On Connector	6
Kit Installation Instruction	1

3. Mounting Clip Kit, no part number, qty. 1

   Contents: 2 Mounting Clips and 2, 8-32 x 1 Screws (see the Parts List at back of this manual for part numbers)

4. I/O Expander Board Kits

   PN16353-52 I/O Expander Board Kit - The I/O Expander Board is factory installed when a Moore 353 with Expansion Board option 1 is ordered.

   - When adding an I/O Expander board to a Standard Case (case Option 2, with black Side Entry Connectors), order connector kit PN 16353-133 to obtain terminals 27-52.
   - When adding an I/O Expander board to a Standard Case with Ethernet connector (case Option 4, with gray or green Direct Entry Connectors), no additional connectors need be ordered.
   - For field installation of this kit, see the supplied Kit Installation Instruction (15900-390).

DESCRIPTION	QUANTITY
I/O Expander Board - Do not remove Board from static shielding bag until it is to be installed.	1
Range Resistor and Reference Junction Kit, see below	1

   PN16353-49 Range Resistor and Reference Junction Kit - This kit is supplied with the above I/O Expander Board Kit and with a factory shipped Moore 353 with Expansion Board option 1.

DESCRIPTION	QUANTITY
4-20 mA to 1-5V Range Resistor, 250Ω, 0.1%, 3W, WW	1
4-20 mA to 15-75 mV Range Resistor, 3.75Ω, 0.1%, 3W, WW	2
Sleeving	5
Crimp-On Connector	6
TC Reference Junction, 100Ω	2
Kit Installation Instruction	1

5. UM353-1, Moore 353 User's Manual (this manual), qty. 1
6. Additional items as required by your order. Refer to the packing list accompanying a shipment.

■

2.0 CONFIGURATION OVERVIEW

Configuration enables a user to select function blocks, stored in the controller, from an available list and enter appropriate block parameters to implement a specific control strategy. Although configuration affects the entire station, the controller partitions related control implementations into LOOPS. A maximum of 99 loops can be configured and 25 can have operator displays that are mapped to network communications[2].

Each LOOP can contain the function blocks listed in the following paragraphs. Signals can be connected between function blocks within the LOOP as well as between loops. Also, there are several STATION function blocks that are fixed and available in the STATION menu for setting station related values.

Section 3 fully describes all available function blocks. For tuning guidelines refer to Section 9.2 Autotune Procedure or request AM-35 Digital Controller Tuning.

NOTE

This User's Manual includes the functionality provided by MPU Controller Board firmware Versions 1.3 and 2.0 through 2.40. These enhancements appear mainly in Sections 2 and 3. They are identified by the phrase "in version 1.3 and higher" or simply "V1.3" or "V2.4" in text.

2.1 STATION FUNCTION BLOCKS

Function blocks that are permanent and accessible at the STATION menu level:

FCO LIB.....**F**actory **C**onfigured **O**ptions **Lib**rary
STATN.....**Stat**io**n** Parameters
SECUR .....**Secur**ity
CLOCK .....real time **CLOCK** (requires firmware V2.2 or higher and RTC/CB board
ETHERNET.....**Ethernet** Communications (requires firmware 2.4 and Ethernet board)

2.2 STATION HARDWARE I/O BLOCKS

Function blocks that are available during configuration depend on the hardware installed in the controller. These blocks can be selected within a LOOP but as fixed resources, once selected, are no longer available. The left column shows the minimum and maximum quantities of each block and the right column shows the quantity for each circuit board.[3]

AIN*1-4* .....**A**nalog **In**put.....MPU Controller Board (3), I/O Expander Board (1)
AINU*1-2* .....**A**nalog **In**put, **U**niversal .....I/O Expander Board (2)
AOUT*1-3*.....**A**nalog **Out**put.....MPU Controller Board (2), I/O Expander Board (1)
DIN*1-4* .....**D**igital **In**put .....MPU Controller Board (3), I/O Expander Board (1)
DINU*1-2* .....**D**igital **In**put, **U**niversal.....I/O Expander Board (2)
DOUT*1-2*.....**D**igital **Out**put.....MPU Controller Board (2)
ROUT*1-2*.....**R**elay **Out**put .....I/O Expander Board (2)

2.3 LOOP FUNCTION BLOCKS

The following blocks are available as needed within each loop in the quantities indicated (the quantity is one if no number is shown). Some blocks (e.g. A/M, BIAS) can be used only once within each LOOP. Others (e.g. ADD) are reusable within a LOOP and can be used up to the maximum number indicated. Each time a reusable block is selected within a LOOP, a new instance number will automatically be assigned (i.e. ADD01, ADD02). Each LOOP can have one operator display block (i.e. ODC or ODS). The display block defines how the loop will be displayed

[2] *Subject to available memory in the controller.*
[3] *Model 352*Plus™ *only: Although these blocks can be selected in configuration, some may not have physical connections to the rear terminals depending upon the positioning of the Option 3 I/O Jumper.*

on the local faceplate when that loop is selected and also how loop data will be mapped on the Modbus or LIL network interface. Each LOOP can have one controller function block (i.e. ID, ONOFF, PD, PID, or PIDAG).

A/M .....**A**uto/**M**anual
ACS*01-99*.....**A**R**C**Co**s**ine (V1.3)
ADD*01-99*.....**Add**ition
AG3.....**AG**A**3** (V1.3)
AG7.....**AG**A**7** (V1.3)
AG8.....**AG**A**8** (V1.3)
ALARM.....**Alarm**
AND*01-99*.....**AND** Logic
ASN*01-99*.....**A**rc**s**i**n**e (V1.3)
ATN*01-99* .....**A**rc**t**a**n**gent (V1.3)
ATD*01-99* .....**A**nalog **T**rend **D**isplay (V1.3)
BATOT.....**Ba**tch **Tot**alizer
BATSW.....**Bat**ch **S**witch
BIAS.....**Bias**
CHR*01-99*.....**Cha**r**r**acterizer
CMP*01-99*.....**C**o**mp**arator
COS*01-99* .....**Cos**ine (V1.3)
DAM*01-99* .....**D**eviation **Am**plifier
DIV*01-99* .....**Div**ision
DNC*01-99*.....**D**ivide by **N C**ounter
DTM*01-99* .....**D**ead **T**i**m**e Table
DYT*01-99* .....**D**ela**y T**imer
E/I.....**E**xternal/**I**nternal Transfer
ESL .....**E**vents **S**equence **L**ogger (V1.3)
EXP*01-99*.....Natural **Exp**onentiation (V1.3)
EXT*01-99* .....**Ex**ponen**t**iation (V1.3)
FTG*01-99* .....**F**alling Edge **T**ri**g**ger
GB*01-99*.....**G**ain & **B**ias
HLD*01-99*.....**H**o**ld**
ID.....**ID** Controller
LL*01-99* .....**L**ead/**L**ag
LMT*01-99*.....**Li**m**it**
LN_*01-99*.....**N**atural **L**ogarithm (V1.3)
LOG*01-99*.....**L**ogarithm Base 10 (V1.3)
MTH*01-99*.....**Ma**t**h**
MUL*01-99* .....**Mul**tiplication
NND*01-99*.....**NAND** Logic
NOR*01-99*.....**NOR** Logic
NOT*01-99*.....**NOT** Logic
ODC .....**O**perator **D**isplay for **C**ontrollers
ODS.....**O**perator **D**isplay for **S**equencers
ODA (V2.2).....**O**p **D**isp for **A**nalog Ind. & Alarm
ODD (V2.2).....**O**p **D**isp for **D**iscrete Ind & Control
ODP (V2.2).....**O**perator **D**isplay for **P**ushbuttons
ONOFF .....**ON OFF** Controller
OR*01-99*.....**OR** Logic
ORSL .....**O**ver**r**ide **Sel**ector
OST*01-99*.....**O**ne **S**hot **T**imer
PB1SW.....**PB1 Sw**itch
PB2SW.....**PB2 Sw**itch
PB3SW.....**PB3 Sw**itch
PCOM.....**P**hase **Com**munication (V1.3)
PD.....**PD** Controller
PID .....**PID** Controller
PIDAG .....**PIDAG** Controller
PRSEQ.....**Pr**ogram **Seq**uencer
QHD*01-99*.....**Q**uickset **H**o**ld**
RATIO.....**Ratio**
RCT*01-99* .....**R**epeat **C**ycle **T**imer
RLM*01-99* .....**R**ate **Lim**iter (V3.0)
ROT*01-99*.....**R**etentive **O**n **T**imer
RSF*01-99* .....**RS F**lip-Flop
RTG*01-99*.....**R**ising Edge **T**ri**g**ger
RTT*01-99* .....**R**eal **T**ime clock **T**rip (V2.0)
SCL*01-99*.....**Sc**a**l**er
SEL*01-99*.....Signal **Sel**ector
SETPT .....**Setp**oin**t**
SIN*01-99*.....**Sin**e (V1.3)
SPLIM .....**S**et**p**oint **Lim**it
SRF*01-99* .....**SR F**lip-Flop
SRT*01-99*.....**S**quare **R**oo**t**
SUB*01-99*.....**Sub**traction
TAN*01-99* .....**Tan**gent (V1.3)
TH*01-99*.....**T**rack & **H**old
TOT01-99 .....**TOT**alizer (V2.3)
TSW*01-99*.....**T**ransfer **Sw**itch
XOR*01-99*.....E**x**clusive **OR** Logic

2.4 LIL GLOBAL DATA I/O FUNCTION BLOCKS

These function blocks are available in the quantities indicated within each loop when the optional LIL Network board is installed. The total number of global function blocks will be limited by the number of global channels available. A controller has 256 channels. Each global data block occupies one global channel. In addition, each configured Control LOOP occupies 5 channels, each configured Sequencer LOOP 6 channels, and the Station itself the first 7 channels. See Section 6 for more information on network communications.

AIL*01-99*.....**A**nalog **I**nput_**L**IL
AOL*01-99* .....**A**nalog **O**utput_**L**IL
DIL*01-99* .....**D**iscrete **I**nput_**L**IL
DOL*01-99*.....**D**iscrete **O**utput_**L**IL

2.5 ETHERNET DATA I/O FUNCTION BLOCKS

These function blocks are available in the quantities indicated within a controller when the optional Ethernet Network board is installed. These blocks can be selected for use within individual loops but block names are unique station wide.

AIE*01-32* **A**nalog **I**nput - **E**thernet (V3.0)
AOE*01-32* **A**nalog **O**utput - **E**thernet (V2.4)
AWE*01-32* **A**nalog **W**rite - **E**thernet (V3.0)
CIE*01-32* **C**oil **I**nput - **E**thernet (V3.0)
CWE*01-32* **C**oil **W**rite - **E**thernet (V3.0)
DIE*01-32* **D**iscrete **I**nput - **E**thernet (V3.0)
DOE*01-32* **D**igital **O**utput - **E**thernet (V2.4)
DWE*01-32* **D**igital **W**rite - **E**thernet (V3.0)

2.6 LonWorks REMOTE I/O FUNCTION BLOCKS

These function blocks are available in the quantities indicated within a controller when the optional LonWorks Remote I/O board is installed. LonWorks is available for use with Models 352P, 353 and 354 controllers. These blocks can be selected within individual loops, but block names will be unique station wide. This allows LonWorks network managers that identify variables using the block name within an individual node to be unique. For example, if LOOP01 uses AIP01 and AIP02 and an AIP block is selected in LOOP02 the name will be AIP03. Detailed information on the use of LonWorks can be found in Section 5. Model 352P only: Select LonWorks by setting the Option 3 I/O Jumper.

AIP*01-25* **A**nalog **I**nput lev_**P**ercent
AOP*01-25* **A**nalog **O**utput lev_**P**ercent
DID*1-6* **D**igital **I**nput lev_**D**iscrete, 16 Channels
DIS*1-6* **D**igital **I**nput_**S**tate (V1.3)
DOD*1-6* **D**igital **O**utput lev_**D**iscrete, 16 Channels
DOS*1-6* **D**igital **O**utput_**S**tate (V1.3)

2.7 CONFIGURATION PROCEDURE

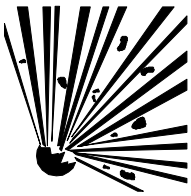
Each controller must be configured to perform the desired control strategy. The arrangement of functions and the numerical data required for a particular control circuit are referred to as the controller configuration. Local and remote configurations are accommodated.

Local configuration involves the configuration pushbuttons and the pulser knob on the Display Assembly's faceplate. Section 9.2 Configuration Mode shows the faceplate and provides brief descriptions of control functions.

Remote configuration requires a personal computer running the i|config™ Graphical Configuration Utility and either a configuration cable or a Modbus, LIL, or Ethernet network connection. The configuration can be created at and downloaded from the personal computer. A network connection is made at the controller's terminals. The configuration cable plugs into the configuration port in the underside of a 352*Plus* or 353 Display Assembly or into a 354N DB9 connector. The other end of this cable connects to a personal computer's serial port or to a modem.

WARNING

Explosion hazard



Explosion can cause death or serious injury.

In a potentially explosive atmosphere, remove power from the equipment before connecting or disconnecting power, signal or other circuits.

Comply with all pertinent regulations regarding installation in a hazardous area.

A configuration is designed by first arranging the needed function blocks in a fashion similar to that of a PI & D drawing. Parameter and calibration values are determined next and then entered on a Configuration Documentation Form or into the Graphical Configuration software. The controller may then be configured locally by entering the information on the form into the controller's configuration memory or remotely by downloading directly from the personal computer.

Nine common controller configurations have been stored in a built-in library that can be entered from the FCO LIB function block at the STATION level. Simple changes can then be made to accommodate individual needs. As an example, FCO101 Single Loop Controller includes the setpoint tracking feature but by simply disconnecting the TC input to the SETPT function block, it becomes a fixed setpoint Single Loop Controller. These FCOs are fully documented in Section 4.

FCO101 - Single Loop Controller w/ Tracking Setpoint
FCO102 - Single Loop Controller with Fixed Setpoint
FCO103 - External Set Controller with Tracking Local Setpoint
FCO104 - External Set Controller with Non-Tracking Local Setpoint
FCO105 - Ratio Set Controller with Operator Setpoint Limits
FCO106 - Single Loop Controller w/Operator Setpoint Limits
FCO107 - Dual Loop Controller
FCO121 - Cascade Loop Controller
FCO122 - Cascade Loop Controller with Operator Setpoint Limits

Unless otherwise specified on the order, FCO101 is installed at the factory. Use the following procedure to change the factory configured option. Refer to Figure 2-1 Configuration Road Map to move to, and then through, the selected FCO and to enter or edit parameter values.

1. Press the ENTER/EXIT CONF button. LOOP will appear on the alphanumeric display.
2. Rotate the Pulser Knob until STATION appears on alphanumeric display.
3. Press the STEP DOWN button to display FCO LIB.
4. Press the STEP DOWN button to display FCO in the lower display.
5. Press the STEP DOWN button until the desired FCO number appears in numeric display.
6. Rotate the Pulser Knob to display the desired FCO number in the upper display.
7. Press the STORE button to load the new FCO.
8. Edit the FCO as needed. In addition to the material in this section, refer to:
    - Section 3 Function Blocks for details about configurable parameters
    - Section 4 Factory Configured Options for FCO diagrams and parameters
    - Sections 6 and 7 for Modbus, LIL, or Ethernet mapping
    - Section 9 Operation for operating controls and displays

Where an FCO is not suitable, a complete configuration can be designed to suit individual needs. Section 4 can be used as a guide for documenting a user-created or used-edited configuration. i|config, a PC-based Graphical Configuration Utility, can be used to design, document, and save configurations as well as download them to the controller, through either the configuration port or using a Modbus, LIL, or Ethernet network connection.

The above steps are illustrated in Figure 2-1 Configuration Road Map. The map also provides a broad overview of the configuration procedure.

- Press the ENTER CONF button to enter the configuration mode. Press the button again to exit configuration.
- After entering the configuration mode, LOOP or STATION can be selected.
- At the STATION level, a factory configured option can be loaded, station parameters can be configured, security passwords can be entered, the clock can be set, communication parameters can be configured, and inputs and outputs can be calibrated.

- Calibration can also be performed within individual loops containing the input or output function blocks used in the LOOP.
- At the LOOP level, new loops can be added, loops can be deleted, or an existing loop can be edited.

When a new loop is created, the controller will assign a default name (e.g. LOOP01). The loop name can be changed to any valid 12-character ASCII value. It is suggested that loop names be limited to 6-characters so that the complete tag name will appear in the alphanumeric display during normal operation.

A Loop can be edited by stepping down from the EDIT menu. If more than one loop has been configured, press the STEP DOWN button and turn the Pulser Knob to step through the list of configured loops. From the selected loop, stepping down will provide various options within the specific loop.

- The current value of all configured block outputs can be viewed.
- The current tag name of the loop and the ESN (Execution Sequence Number) can be changed. ESNs are automatically assigned by the controller in the order of creation, either a loop or individual block. An ESN should be changed when it is important that one loop be executed prior to another (e.g. cascade primary executes prior to the cascade secondary).
- Function blocks can be added to or deleted from the loop. Existing function blocks can be edited. Use the step up and step down buttons to move between the function block, parameter, and value levels within the EDIT FB menu.

If no configuration entries are made for about three minutes, the mode will time out and the controller will exit the configuration mode. The STATN function block has a CONFG TO (Configuration Timeout) parameter to enable or disable timeout.

Loading an Earlier Firmware Version

In rare instances, replacing the installed MPU Controller board firmware with an earlier version may be desired. Before loading the earlier firmware, refer to the sections on configuration and load FCO-0 (zero) as the active configuration. This will install a minimum configuration and will reduce the number of error messages that appear during the firmware loading process.

2.8 OPERATION DURING LOCAL ON-LINE CONFIGURATION

Changing a controller's configuration parameters while the station is on-line can affect its operation and output values. Configuration parameters are divided into four types: HARD, SOFT, READ, and CALIBRATION.

HARD - When a HARD parameter is STORED the controller will suspend execution of all function blocks and will hold all outputs until the EXIT button is pressed. A HARD parameter is identified with each '(H)' notation in a function block parameter listing in Section 3. When a loop or function block is added or deleted, the station enters a HARD configuration mode.

SOFT - A SOFT function block parameter can be changed while the function blocks are executing. A SOFT parameter is identified with each '(S)' notation in a function block parameter listing in Section 3. All QUICKSET changes also fall into this category.

READ - These parameters are not changeable and therefore can be read while the station function blocks are executing. A READ parameter is identified with each '(R)' notation in a function block parameter listing in Section 3. The configuration VIEW mode also falls into this category.

CALIBRATION - When entering the CONFIGURATION mode, the station will suspend execution of all function blocks and will hold all outputs until the EXIT button is pressed. If an output block is being calibrated its output will be adjusted during the calibration procedure. A CONFIGURATION parameter is identified with each '(C)' notation in a function block parameter listing in Section 3. The calibration mode can be entered from the individual block or from the CAL mode at the station level.

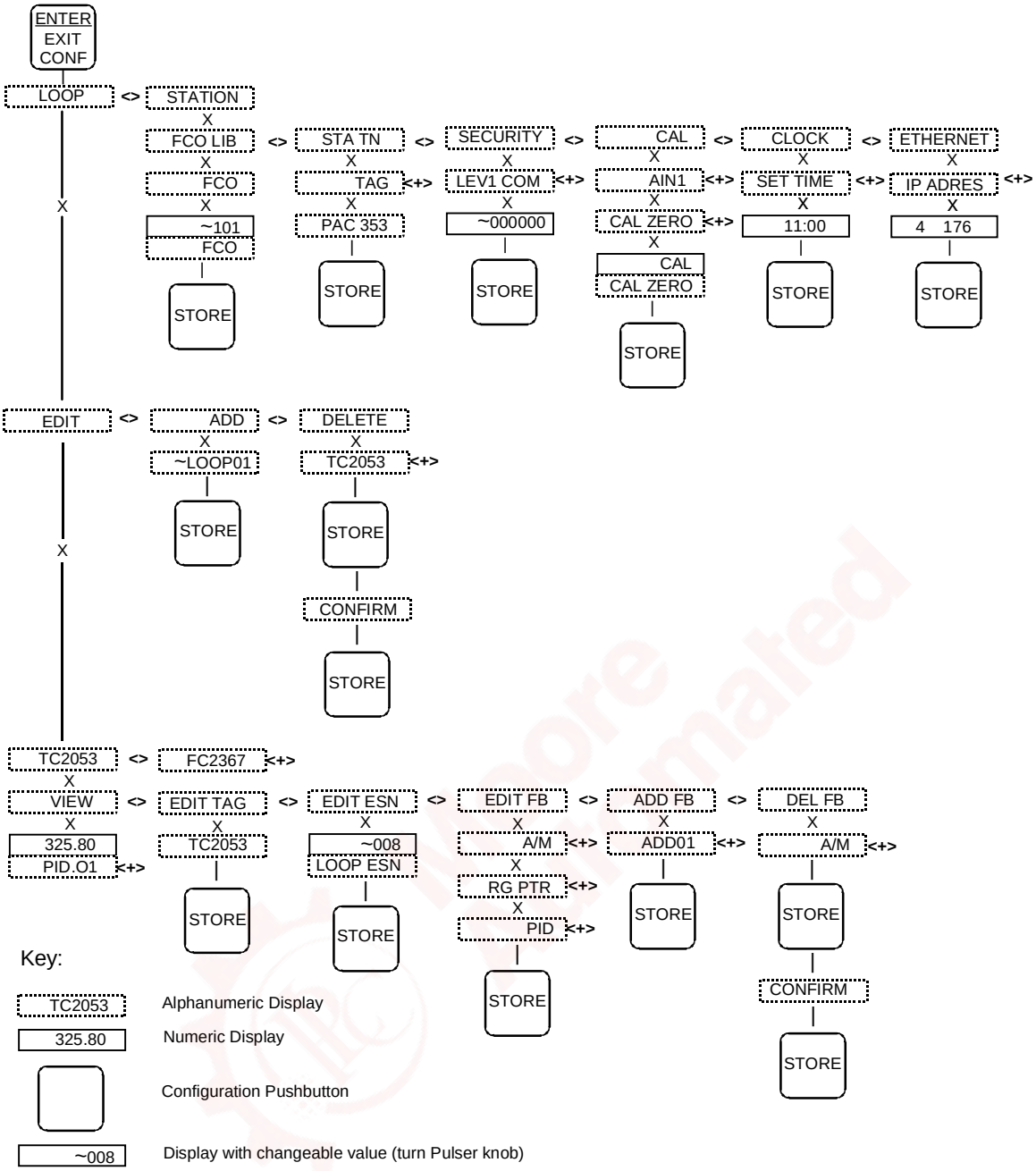


FIGURE 2-1 Configuration Road Map

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Moore Automated - Global Supplier Of Industrial Automation Parts

· Expert Consultancy: Technical sales specialists with 10+ years of industry expertise

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