



USER INSTRUCTIONS

Limitorque Master Station III

FCD LMENIM5001-02 – 12/13

Installation
Operation
Maintenance



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1 Introduction

1.1 Overview

The next-generation master station is designed and manufactured by Flowserve Limatorque specifically for use with the Limatorque line of (Modbus) electric actuators. The Master Station III (MSIII) acts as a single-source controller for up to 250 actuators with full redundancy, e-mail alert notification, and multi-lingual support.

The Master Station III is a plug-and-play solution that provides complete control, monitoring, and diagnostics of Limatorque electric actuators through a simple touch-panel display serving as a Human Machine Interface (HMI).

1.2 User Role Overview

The Master Station requires users to login. Four user role levels are configurable for each user: View, Control, Configure, and Administrator. Each role includes the rights of the lesser roles (i.e., Control includes View's rights, and Configure includes Control's rights and View's rights).

VIEW: the user can view the network status and the activity log. No control or configuration functionality is available.

CONTROL: in addition to View rights, the user has the ability to control MOVs.

CONFIGURE: in addition to Control rights, the user has the ability to configure the Master Station and the Network.

ADMINISTRATOR: in addition to Configure rights, the user has the ability to add or delete users, as well as modify user settings.

These roles can be changed by an Administrator user. See Section 8.2.4, User Administration for details.

1.3 Login

When the Master Station completes the boot process, it loads the Introduction screen (Figure 1.1).

Figure 1.1 - Introduction



Touching any part of the screen will load the Enter User Name screen (Figure 1.2).

NOTE: If the screen is blank and the green LED is illuminated, the unit is in screen saver mode. Touch the display to exit the screen saver mode.

Figure 1.2 - Enter User Name



Once the user name has been entered, the Enter Password screen will be displayed (Figure 1.3).

NOTE: Each user name must have a unique password.

Figure 1.3 - Login



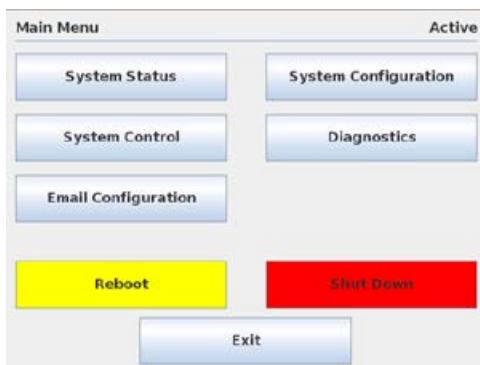
Passwords and user names are set via the User Administration menu, under System Configuration. The correct password entry for the respective user name will advance the screen to the Main Menu (Figure 1.4).

In the event that passwords are lost or forgotten, please contact your Limitorque service coordinator at (434) 528-4400.

1.4 Main Menu

Once logged in, the user will see the Main Menu (Figure 1.4).

Figure 1.4 - Main Menu



From here, the menu options are displayed based on the current user role. Each button represents a separate logical section of the Master Station:

SYSTEM STATUS (ALL USERS): View information related to the network status, status of the Master Station, and MOV status.

SYSTEM CONTROL (CONTROL, CONFIGURE, AND ADMINISTRATOR): Access to MOV control and emergency shutdown functions.

EMAIL CONFIGURATION (CONFIGURE AND ADMINISTRATOR): View and change settings related to email alerts.

SYSTEM CONFIGURATION (CONFIGURE AND ADMINISTRATOR): Configure the main functions of the Master Station. User Administration functions in this section are accessible only to Administrator users.

DIAGNOSTICS (CONFIGURE AND ADMINISTRATOR): Activate event logging, communication data analysis, or polling statistics.

REBOOT: Restart the Master Station.

SHUT DOWN: Turn off the Master Station.

EXIT: Log out of the Master Station user mode.

1.5 Technical Data

1. Power supply: 100-240 VAC 50/60HZ or 24 VDC. Maximum current is 1.5 A.
2. Operating temperature: 0-60°C (32-140°F)
3. Enclosure: Desktop/Shelf housing (standard), 19" rack mountable (optional), NEMA 4/4X wall-mountable (optional), or mounted in a stand-alone cabinet (optional). Standard dimensions are 16" (w) x 8.25" (h) x 18.5" (d)
4. Human machine interface: 5.6" diagonal, 640x480 resolution, lighted, TFT color graphic LCD. Supports multiple languages: English, Spanish, Italian, German, and French.
5. Electromagnetic Compatibility (EMC) Compliance:
 - a. Emissions/Immunity – EN 61326-1:2006
 - b. Harmonics – EN 61000-3-2
 - c. Flicker – EN 61000-3-3
6. Communication protocol – MSIII to Field Units: Modbus RTU
7. Communication protocol – MSIII to Host System: Modbus RTU or Modbus TCP/IP
8. Network topology – Bi-directional redundant loop or multi-drop/daisy chain
9. Physical layer – MSIII to field units: EIA-485 (RS-485)
10. Physical layer – MSIII to Host System: TIA-232 (RS-232) / EIA-485 (RS-485) /EIA-422 (RS-422) / Ethernet
11. Unit redundancy options: MSIII module redundancy, isolated power connections (standard)
12. Communications Rate – MSIII to field units: 19.2 Kbaud max (Serial)
 Host System to MSIII: 115.2 Kbaud max (Serial)
 Host System to MSIII: 100 Mbits per second max (Ethernet)
 Maximum recommended host system polling rate at 9.6 Kbaud and above:
 - 125 register reads / 500 ms
 - 44 register writes / 500 ms

Table 1.1 - Network Topology Cable Specifications

Network Topology (kbit/s)	Max. Segment Length (Belden 3074F with no repeaters, meters)	Max. Cable Length (kilometers)
Multi-drop/Daisy Chain (with 24 field units)	1200	30
Redundant Loop (with 240 field units)	1200	289.2

2

Function Flowchart

The following flowchart graphics illustrate the functions of the Master Station III.

Figure 2.1 - Function Flowchart

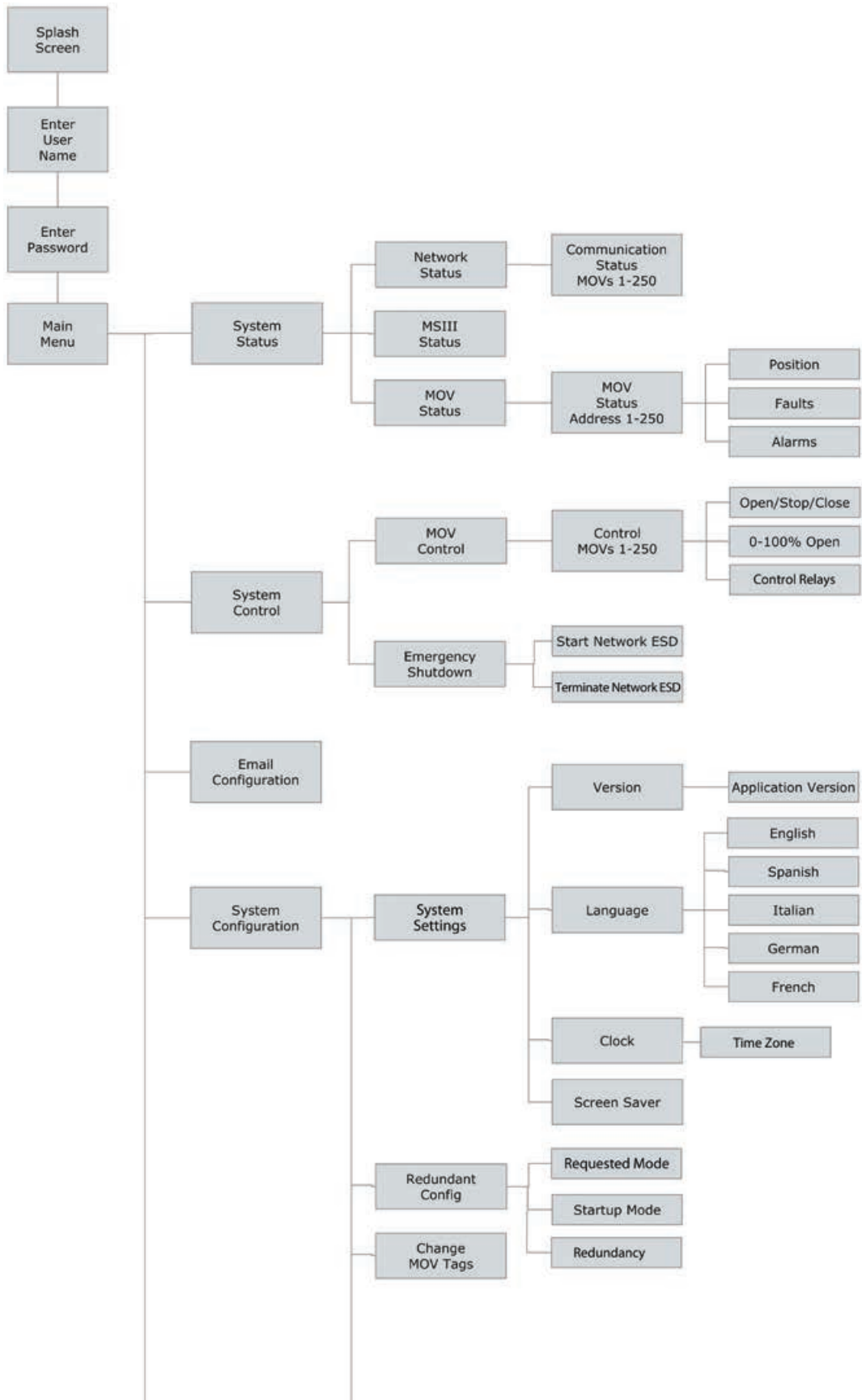
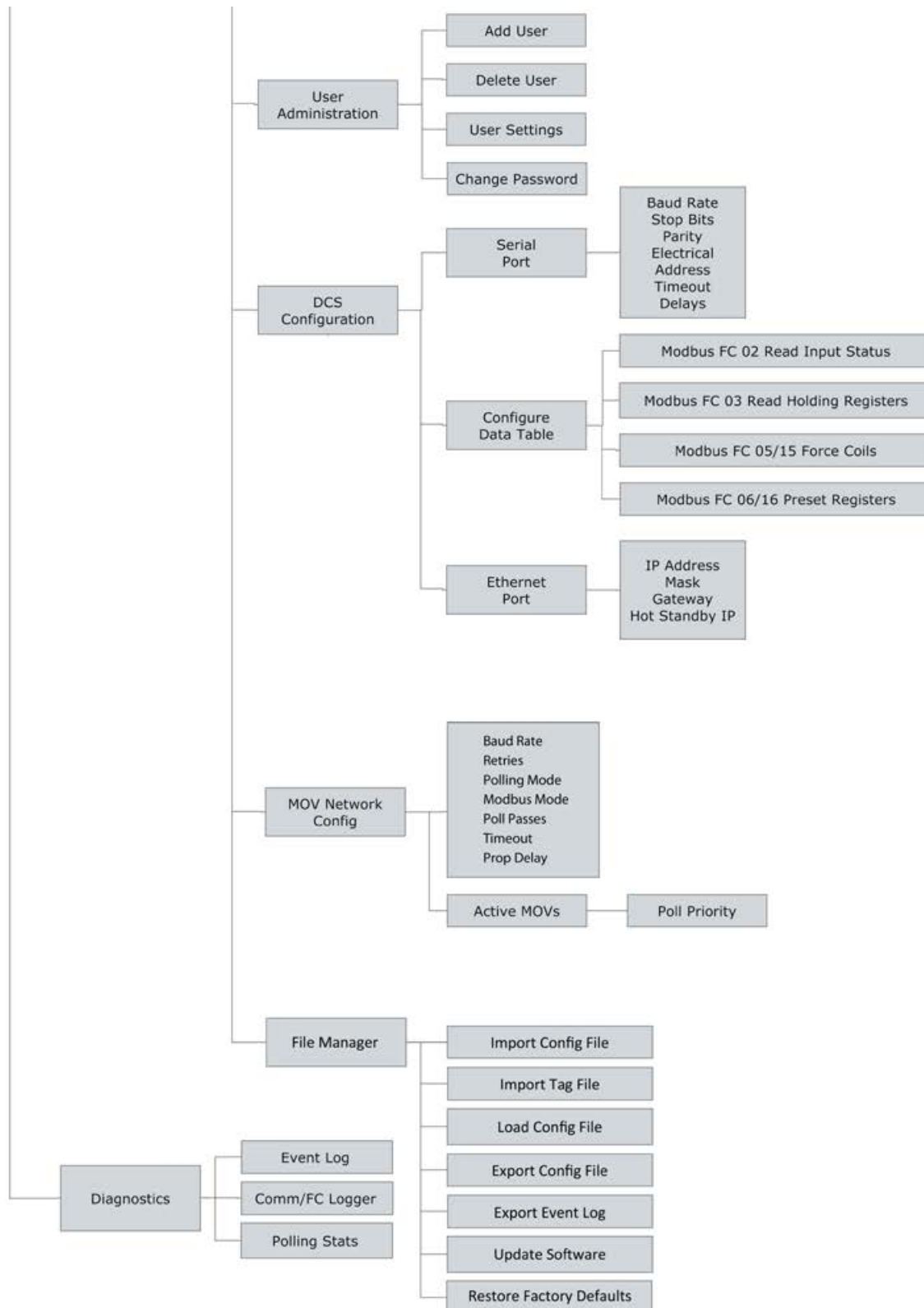


Figure 2.1 - Function Flowchart (continued)



3

Quick Startup

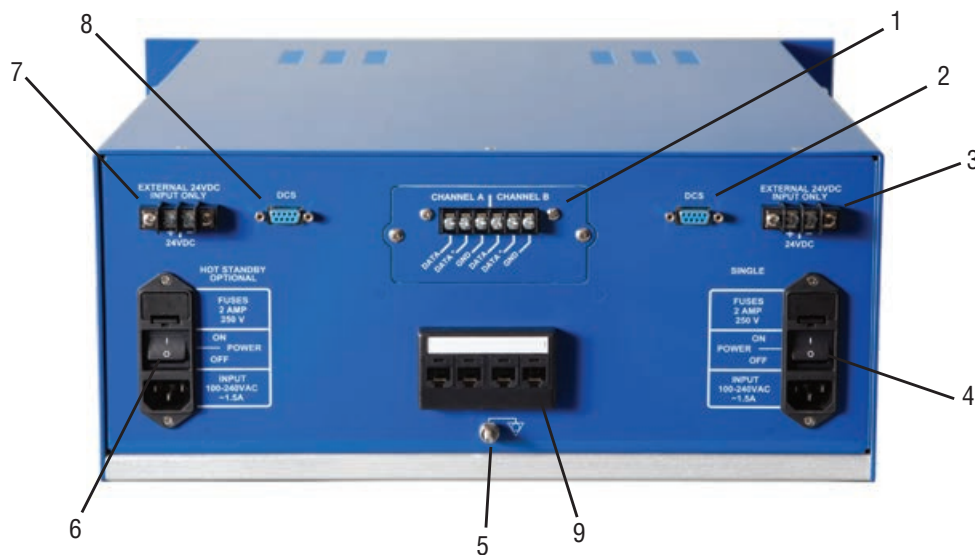
3.1 Master Station Quick Startup Instructions

1. Connect earth ground (#14AWG minimum) wiring, MOV network cables (Belden #3074F/#9841/#3107), and power cable.
2. Apply power to the Master Station.
3. Wait for the Master Station to display the start-up screen.
4. Touch the screen, then enter user name "FLOW". Select Enter.
5. Enter password "100" when prompted. Select Enter.
6. Next select "System Configuration" then "Redundant Configuration".
7. Set the requested mode to "Disabled", startup mode to "Active", and redundancy mode to desired setting.
8. Next select the "back" button and in the "System Configuration" select "User Administration".
9. Set up user accounts per Section 8.2.4.
10. Select "MOV Network Config" and set up per Section 8.2.6.
11. Select "DCS Configuration" and set up per Section 8.2.5.
 - For remote DCS control, the three primary registers of interest are:
 - 46001: Register for HS Status (Read Only): 0=idle, 1=standby, 2=hot
 - 46002: Register for Host System to toggle (Write Only): 3=toggle state
 - 46191: Register for Internal Program Execution Heartbeat/Watchdog (Read Only): Updates every scan, 8-bit integer
 - Further adjustments may be made by following the procedures outlined in this manual.
12. Tap the "Back" button to return to the "System Configuration" screen.
13. Select "Redundant Config" and change the requested mode to "Active".

4 Connections

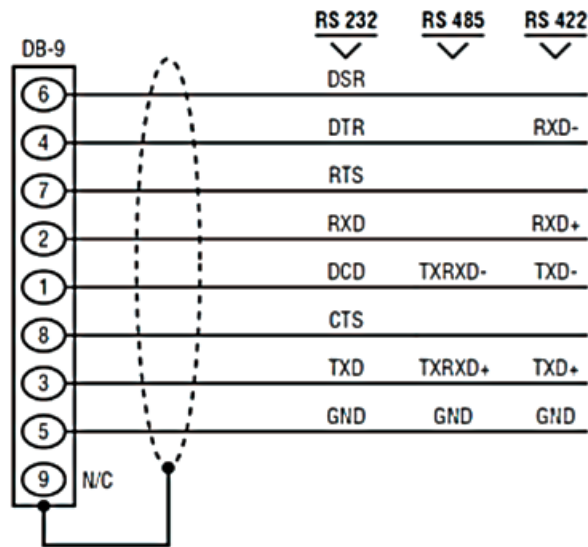
4.1 Master Station Rear Panel Connections

Figure 4.1 - Master Station Rear Panel Connections



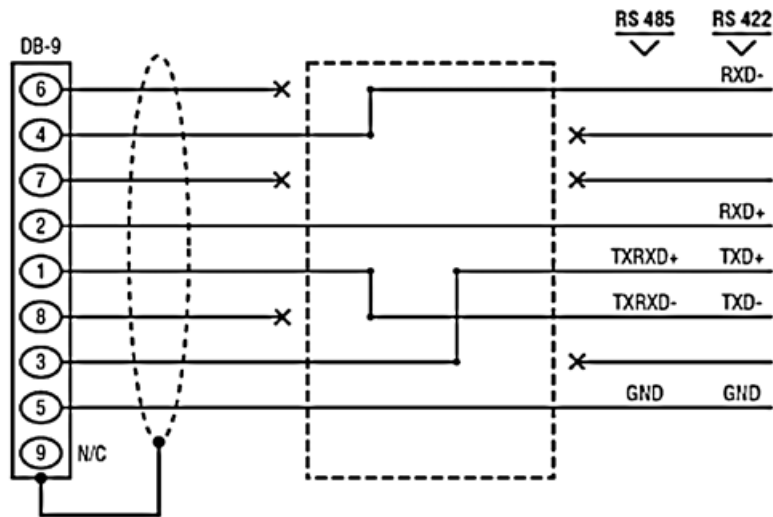
1. Ethernet Ports, RJ-45 connectors. One port is designated for MNET (Modbus Ethernet TCP/IP). The other port is for the webservice. Either port may be used for either function as they are connected to the same CPU.
2. Main DCS Port. DB-9 Female connector. Port may be RS-232 or RS-422 or RS-485. Each electrical standard uses a different wiring convention.

Figure 4.2 - DCS Port Connection



NOTE: For cases where an existing Master Station II is being replaced with a Master Station III, an adaptor is required for communications over RS-485 or RS-422. Pin changes to support an existing MSII setup are detailed in Figure 4.3. Consult factory if an adaptor is needed.

Figure 4.3 - DCS Port Connection with MS2/MS3 Adaptor



3. Auxiliary 24 VDC power connection for Main.
4. Main power switch and connector for 120 – 240 VAC.
5. Electrostatic Ground. A good quality earth ground **MUST** be attached to the Master Station. An effective local, low-impedance earth ground (less than 5 ohms) is required.

- 6. Hot Standby unit main power switch and connector for 120 – 240 VAC.
- 7. Auxiliary 24 VDC power connection for Hot Standby.
- 8. Hot Standby DCS Port. DB-9 Female connector. Port may be RS-232 or RS-422 or RS-485. Each electrical standard uses a different wiring convention.
- 9. Network Connections- Channel A and B. Connections for the network wiring for channels A and B. See Tables 4.1 and 4.2 below for connection details.

NOTE: Each module (Main or Hot Standby) can support any combination of the two power inputs (Main 120-240 VAC, 24 VDC).

Table 4.1 - Network Channel A Connection

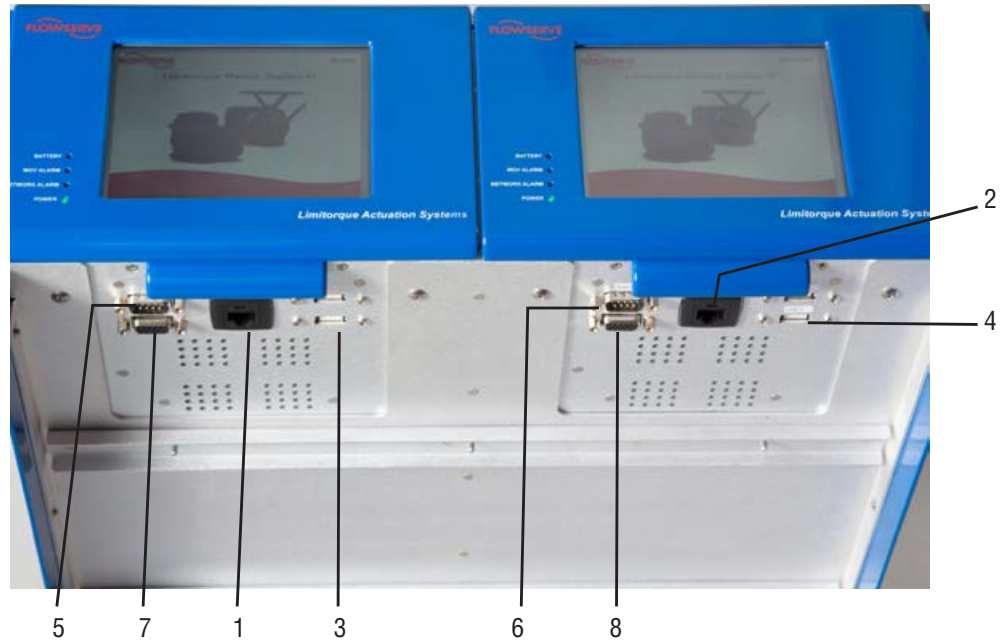
Connector	MX/QX	UEC-3-DDC
DATA-A1 (+)	13	TB4 D-S
DATA-A1* (-)	14	TB4 D-S*
Shield	N/C	

Table 4.2 - Network Channel B Connection

Connector	MX/QX	UEC-3-DDC
DATA-A2 (+)	5	TB3 D-M
DATA-A2* (-)	4	TB3 D-M*
Shield	3	

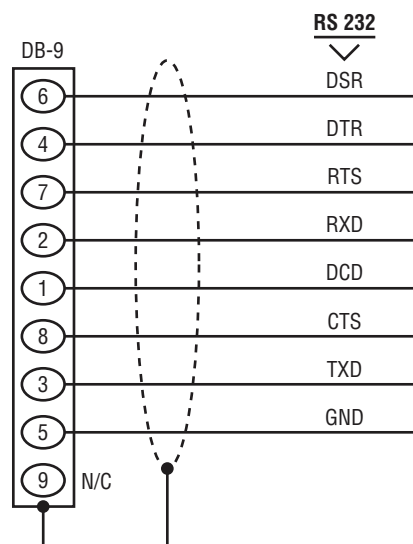
4.2 Master Station Front Panel Connections

Figure 4.4 - Master Station Front Panel Connections



1. Ethernet Port, RJ-45 connector. Can be used for MNET (Modbus Ethernet TCP/IP) or for the webserver.
2. Hot Standby Ethernet Port, RJ-45 connector. Can be used for MNET (Modbus Ethernet TCP/IP) or for the webserver.
3. USB Ports.
4. Hot Standby USB Ports.
5. Printer / Debug Port. DB-9 Female connector. RS-232 port. Used for Master Station diagnostics.

Figure 4.5 - Debug Port Connection



6. Hot Standby Printer / Debug Port. DB-9 Female connector. RS-232 port. Used for Master Station diagnostics.
7. VGA Port. Used for connecting a monitor to the Master Station Main unit.
8. Hot Standby VGA Port. Used for connecting a monitor to the Master Station Hot Standby unit.

4.3 Master Station Wiring Requirements

The network cable connects the field units to the host controller or Master Station. Belden 3074F, 3105A, or 9841 shielded, twisted-pair cable should be used. The use of other cables may result in a reduction of internodal distances or increased error rate, and is the user's responsibility.

BELDEN 3074F SPECIFICATIONS

- Total cable length between repeaters or nodes with repeaters: up to 19.2 kbps: 4000' (1.2 km)

For loop mode, this is the total length between operating field units. If a field unit loses power, the relays internal to the field unit connect the A1 Channel to the A2 Channel, which effectively doubles the length of the cable (assuming a single field unit fails). To ensure operation within specifications in the event of power failure to field units, this consideration must be added. **Example:** To ensure operation within specification when any two consecutive field units lose power, the maximum length of cable up to 19.2 kbps should not exceed 4000' (1.2 km) per every four field units.

Key Specifications

- Resistance/1000 ft = 18 AWG (7 x 26) 6.92 ohms each conductor (13.84 ohms for the pair)
- Capacitance/ft = 14 pF (conductor-to-conductor)
- Capacitance/ft = 14 pF (conductor-to-shield)

BELDEN 3105A SPECIFICATIONS

- Total cable length between repeaters or nodes with repeaters: up to 19.2 kbps: 4000' (1.2 km)

For loop mode, this is the total length between operating field units. If a field unit loses power, the relays internal to the field unit connect the A1 Channel to the A2 Channel, which effectively doubles the length of the cable (assuming a single field unit fails). To ensure operation within specifications in the event of power failure to field units, this consideration must be added. **Example:** To ensure operation within specification when any two consecutive field units lose power, the maximum length of cable up to 19.2 kbps should not exceed 4000' (1.2 km) per every four field units.

Key Specifications

- Resistance/1000 ft = 22 AWG (7 x 30) 14.7 ohms each conductor (29.4 ohms for the pair)
- Capacitance/ft = 11.0 pF (conductor-to-conductor)
- Capacitance/ft = 20.0 pF (conductor-to-shield)

BELDEN 9841 SPECIFICATIONS

- Total cable length between repeaters or nodes with repeaters: up to 19.2 kbps: 3500' (1 km)

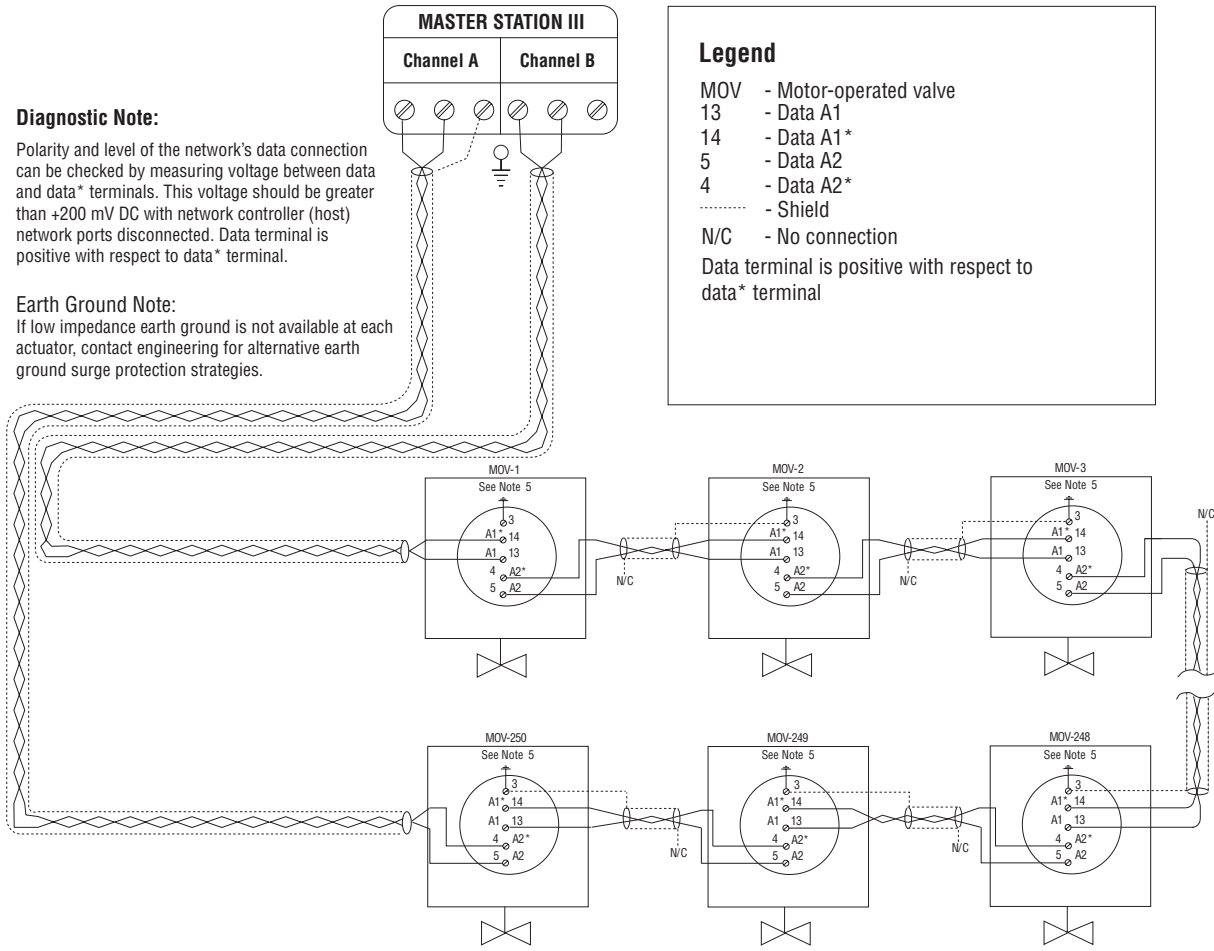
For loop mode, this is the total length between operating field units. If a field unit loses power, the relays internal to the field unit connect the A1 Channel to the A2 Channel, which effectively doubles the length of the cable (assuming a single field unit fails). To ensure operation within specifications in the event of power failure to field units, this consideration must be added. **Example:** To ensure operation within specification when any two consecutive field units lose power, the maximum length of cable up to 19.2 kbps should not exceed 3500' (1 km) per every four field units.

Key Specifications

- Resistance/1000 ft = 24 AWG (7 x 32) 24 ohms each conductor (48 ohms for the pair)
- Capacitance/ft = 12.8 pF (conductor-to-conductor)
- Capacitance/ft = 23 pF (conductor-to-shield)

4.4 Master Station Network Topologies

Figure 4.6 - Modbus Redundant Loop Topology



Notes:

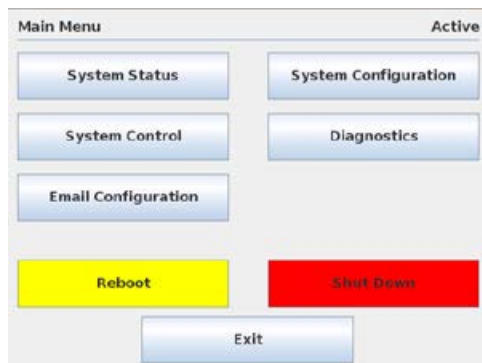
- 1) Belden 3074F, 3105A, or 9841 shielded cable is recommended.
- 2) Correct polarity for field unit and network controller connection is necessary for proper operation.
- 3) Connections shown are typical. The number of MOVs shown may not indicate true system size.
- 4) ⚡ Earth ground: ground rod
- 5) ⚡ Earth ground: ground rod or lug in actuator if actuator is grounded.

5 System Status

5.1 Main Menu

Upon successful login as a user assigned to any role level, the System Status button on the Main Menu screen will be present. Simply touching the System Status button will advance the HMI display to the System Status screen (Figure 5.2). By selecting Exit, the user will end the session and log out.

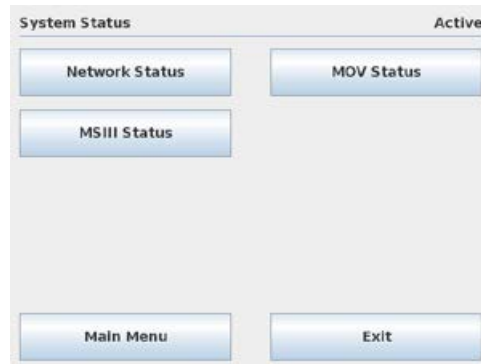
Figure 5.1 - The Main Menu screen



5.2 System Status

The System Status main screen (Figure 5.2) allows the user to view the overall status of the MOV network and Master Station.

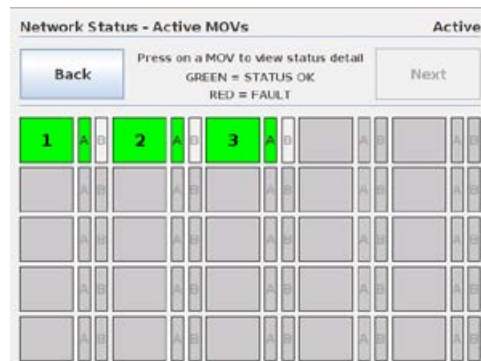
Figure 5.2 - System Status



5.2.1 Network Status

The Network Status screen presents an overview of the entire field unit network, up to 25 activated MOVs per page. Only those MOVs that have been activated will be displayed. See MOV Network Config in System Configuration screen to activate desired MOVs.

Figure 5.3 - Network Status

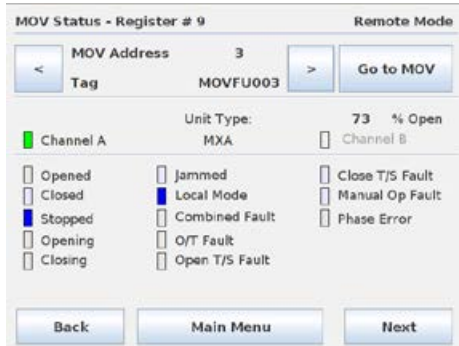


The numeric buttons represent addressed MOVs, while the A and B bars represent associated MOV communication channels A&B. The MOVs and their respective communication channels are constantly being monitored and will display green if OK and red if faulted. The user can advance to the MOV Status screen by either touching an addressed MOV or touching the Back button to return to System Status screen, and then selecting MOV Status.

5.2.2 MOV Status

The MOV Status screen reveals the actual MOV network address, tag name, unit type, and position. In addition, it shows the status of the MOV communication channels and the Modbus holding registers that have been selected to be mapped to the PLC/DCS data table. See Section 8.2.5.3 Configure Data Table for register content details.

Figure 5.4 - MOV Status



By default the Unit Type is not read from the MOVs and will show up as “Not Available” on the MOV Status screen. In order to obtain and display the Unit type, the user must make some changes to the DCS Data Tables as explained in section 8.2.5.3 - Configure Data Tables.

To view the Unit Type:

1. Under ‘Modbus FC 03’ submenu, include Register #11 (Digital Outputs) in the block of registers being read from the MOVs.
2. Under ‘Modbus FC 02’ submenu, include the four MOV Series bits (from Register #11) in the set of inputs available for reading.

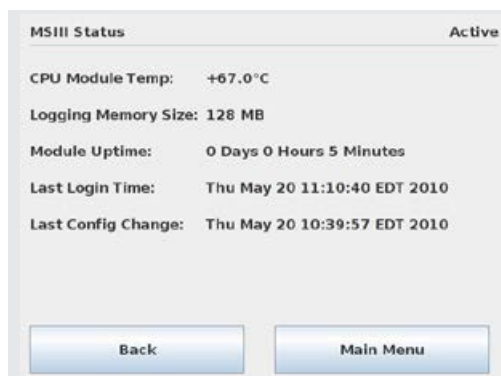
Returning to the MOV Status screen will now display the Unit Type along with the rest of the MOV status information.

5.2.3 MSIII Status

The MSIII Status screen provides Master Station status of the following functional components:

1. CPU Module temperature
2. Available memory for logging data
3. CPU Module up-time
4. Last login time
5. Last configuration change time

Figure 5.5 - MSIII Status

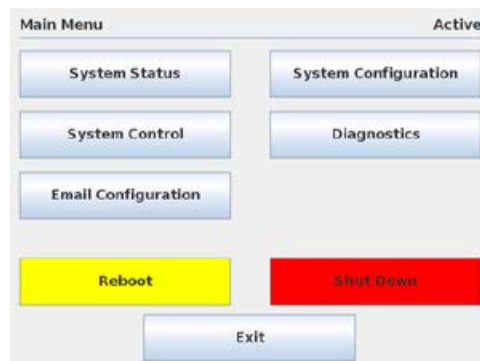


6 System Control

6.1 Main Menu

Upon successful login as a user assigned to a Control, Configure, or Administrator role, the System Control button on the Main Menu (Figure 6.1) will be present. Simply touching the System Control button will advance the HMI display to the System Control screen (Figure 6.2). By selecting Exit, the user will end the session and log out.

Figure 6.1 - Main Menu



6.2 System Control

The System Control screen (Figure 6.2) allows for the selection of either MOV Control or Emergency Shutdown, over the network.

Figure 6.2 - System Control



6.2.1 MOV Control

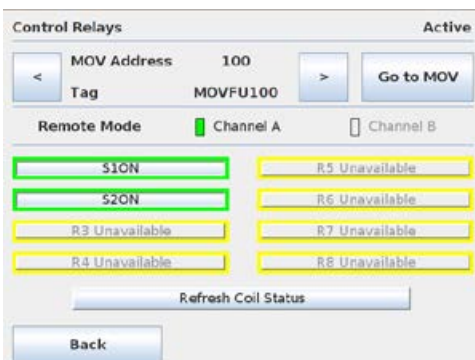
The MOV Control screen (Figure 6.3) allows for a selected MOV to be opened, stopped, closed, or moved to a set position (such as 38% open). As shown in Figure 6.3, if the torque register is selected (see Section 8.2.5.3.2), the MOV Control screen displays the torque reading during MOV operation for the latest generation smart actuators. MOV control relays can also be energized from this screen if the relays are configured for network control within the MOV.

Figure 6.3 - MOV Control



The Control Relays screen (Figure 6.4) allows for a selected MOV's relay to be toggled on and off. To do this the DCS Function Code 05/15 Coils must be enabled as described in Section 8.2.5.3.3. Additionally the relays must be configured for network control within the specific MOV. Toggle a coil by tapping on the desired coil text box.

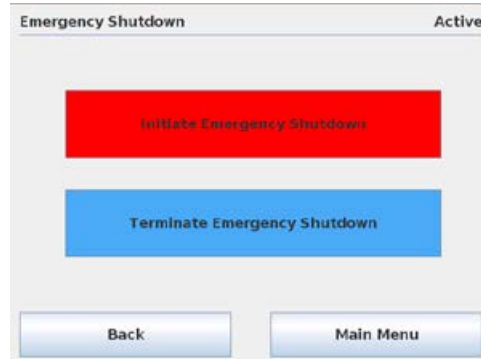
Figure 6.4 - Control Relays



6.2.2 Emergency Shutdown

Should it be necessary to initiate an Emergency Shutdown of the networked MOVs, this can be accomplished by accessing the Emergency Shutdown screen (Figure 6.5) from the Main Menu.

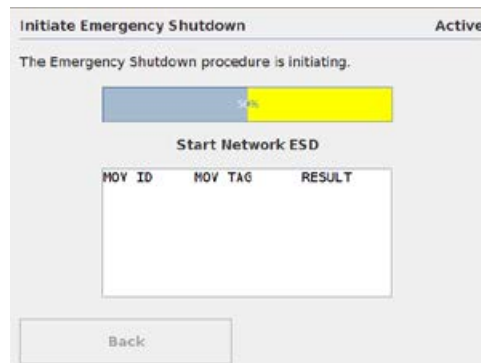
Figure 6.5 - Emergency Shutdown



Two options are available: Initiate Emergency Shutdown and Clear Emergency Shutdown. Once an emergency shutdown has completed and is no longer necessary, the emergency shutdown state can be cleared by pressing the Clear Emergency Shutdown button.

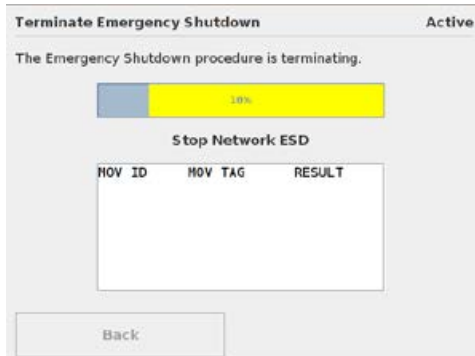
When an emergency shutdown is initiated, the Emergency Shutdown in Progress screen will be displayed (Figure 6.6).

Figure 6.6 - Emergency Shutdown in Progress



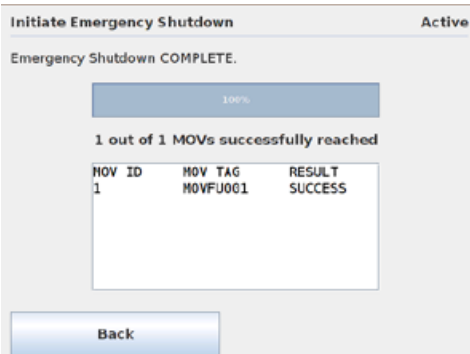
When an emergency shutdown is terminated, the Emergency Shutdown Termination in Progress screen will be displayed (Figure 6.7) until the procedure is complete.

Figure 6.7 - Emergency Shutdown Termination



When an emergency shutdown is either initiated or terminated, the Emergency Shutdown action screen will display a listing of the networked MOVs and their acknowledgement of the signal.

Figure 6.8 - Emergency Shutdown Initiation Complete

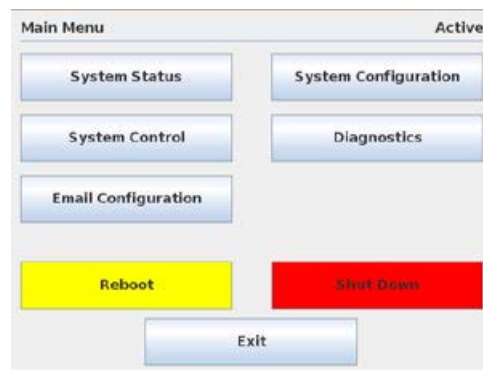


7 Email Configuration

7.1 Main Menu

Upon successful login as a user assigned to either Configure or Administrator role level, the System Configuration button on the Main Menu screen will be present. Simply touching the Email Configuration button will advance the HMI display to the Email Notification Screen (Figure 7.2). By selecting Exit, the user will end the session and log out.

Figure 7.1 - Main Menu



7.2 Email Configuration

The Email Configuration allows the user to setup and maintain email notification alerts for network faults, DCS port faults, ESD activity, HOT/STANDBY changes, and/or MOV alarms. Each email entry can be independently configured for any/all alarm events. In the event of an alarm, any email addresses configured for that particular fault will be sent a notification email that a fault has occurred.

Figure 7.2 - Email Notification Screen



7.2.1 SMTP Configuration

NOTE: SMTP Email Setup must be completed before email addresses can be added to the mailing list.

Email notification is enabled by setting up a SMTP server and valid email account in the Master Station III. This can be done either with an accessible private SMTP server and email account or by creating a new email address with Gmail (service provided by Google) and utilizing their public SMTP server.

To set up the email account first enter the SMTP host by selecting the button left of the “Configure” button.

Figure 7.3 - SMTP Address



Once the SMTP host has been configured, select the “Configure” button to finish setting up the outgoing email. Depending on the type of connection the user specifies, the account login may be configured with or without a password as shown in Figures 7.4 and 7.5. The connection type can also be configured with or without SSL.

Figure 7.4 - SMTP Configuration without Password

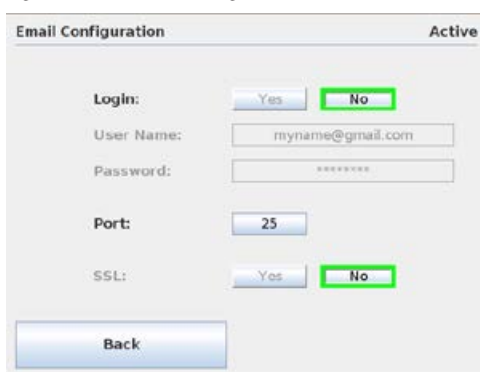
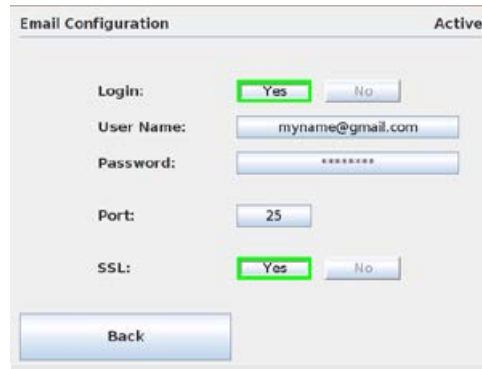


Figure 7.5 - SMTP Configuration with Password



Once the SMTP Host Address and SMTP Email Account have been configured, the IP address of the Master Station III must be set in the Email Notification Screen. Set the Primary and Secondary DNS addresses by selecting the octet fields.

7.2.2 Alarm Listener Configuration

Once the SMTP configuration has been completed, alarm listeners can be added to the email notification system so that email alerts are sent when any of the following network events occur: Network Fault, DCS Port Fault, Emergency Shutdown, Hot Standby Change, or MOV Alerts. Any or all of the Master Station III events can be selected for each individual listener.

To add an event listener, click the “Add” button on the Email Notification Screen and enter the desired email address as shown in Figure 7.6.

Figure 7.6 - Add Email Listener



After entering desired email address, the Master Station will send a confirmation email to the address. Check the email account to verify that the email address was entered correctly.

Following the email verification, the Master Station returns to the Email Notification screen where the email address can be selected and alerts added to the selected email. Click on the desired notifications for the email address. Selections are highlighted in green as seen in Figure 7.7.

Figure 7.7 - Alarm Selections

The screenshot shows the 'Email Notification' configuration interface. At the top right, it says 'Active'. On the left, there is a list of email addresses with 'email@example.com' selected. To the right of this list are five buttons representing different alarm types: 'Network Fault', 'DCS Port Fault', 'Emergency Shutdown', 'Hot Standby Change', and 'MOV Alerts'. The first three buttons ('Network Fault', 'DCS Port Fault', and 'Emergency Shutdown') are highlighted with a green border, indicating they are selected. Below the email list, there are configuration fields for SMTP (smtp.gmail.com), Primary DNS (8.8.8.8), and Secondary DNS (8.8.4.4). At the bottom of the screen are three buttons: 'Back', 'Add', and 'Delete'.

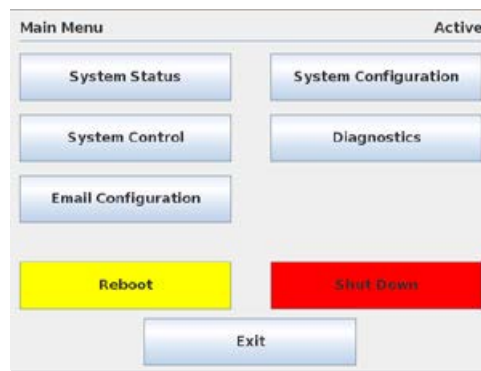
8

System Configuration

8.1 Main Menu

Upon successful login as a user assigned to either Configure or Administrator role level, the System Configuration button on the Main Menu screen will be present. Simply touching the System Configuration button will advance the HMI display to the System Configuration screen (Figure 8.2). By selecting Exit, the user will end the session and log out.

Figure 8.1 - Main Menu



8.2 System Configuration

The System Configuration main menu allows the user to view/configure eight distinct areas within the Master Station:

System Information: provides current firmware version and access to settings for language, clock and screensaver.

Redundant Config: provides access to setting the unit’s current mode, startup mode, and redundancy mode.

Change MOV Tags: allows for customizing MOV tag names for each addressed unit.

User Administration: present when logged in as Administrator, it permits the addition/deletion of users and their respective roles.

DCS Configuration: enables communication settings to the Host device.

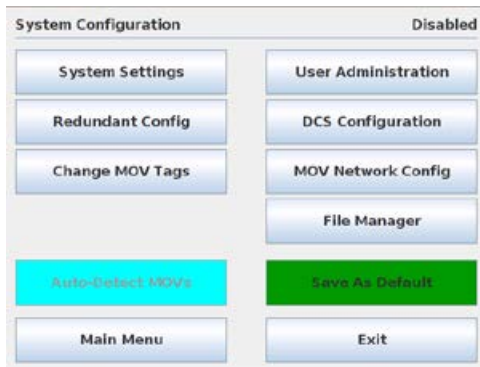
MOV Network Config: enables user to select active MOVs for the RS-485 field network.

File Manager: enables user to load, save, or restore a system configuration as well as import unit tags, update software, and export events log.

Auto-Detect MOVs: scans the network for connected MOVs and adds them to the network configuration. The Master Station must be configured as the active master (Refer to Section 8.2.2 Redundant Configuration) in order to execute the scan.

Save As Default: saves the current network configuration as default. This default is saved as a file and is loaded automatically whenever the Master Station is turned on or rebooted.

Figure 8.2 - System Configuration



8.2.1 System Settings

The System Settings menu (Figure 8.3) allows the user to view the Master Station’s currently loaded firmware version. In addition, the menu provides means for setting the system clock, screen saver, and language parameters.

NOTE: Changing any of the System Settings is disabled when the unit is running in “Active” mode. The only option available to view in “Active” mode is the software version. To turn off “Active” mode and make changes to the System Settings, go to the System Configuration menu as detailed in Section 8.1 and select the “Redundant Config” button. Under the Requested Mode title, select the “Disabled” button and tap the “Back” button to return to the System Configuration screen. All the System Settings can now be changed by tapping the “System Settings” button and following the proceeding directions.

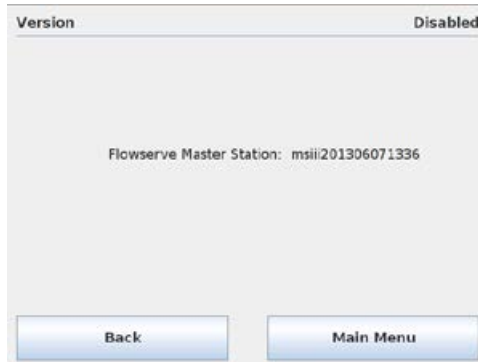
Figure 8.3 - System Settings



8.2.1.1 Version

The Version screen (Figure 8.4) displays the Master Station's currently loaded firmware version.

Figure 8.4 - Version



8.2.1.2 Language

The Language menu (Figure 8.5) allows the user to set the unit's display language by selecting the desired language button.

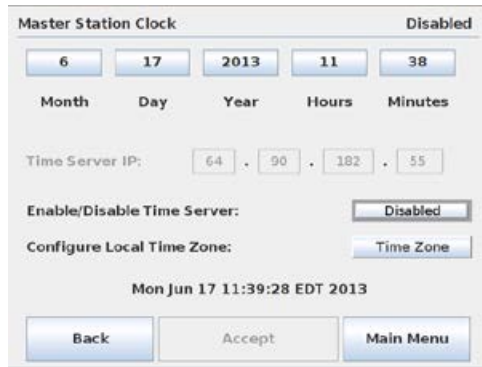
Figure 8.5 - Language Menu



8.2.1.3 Clock

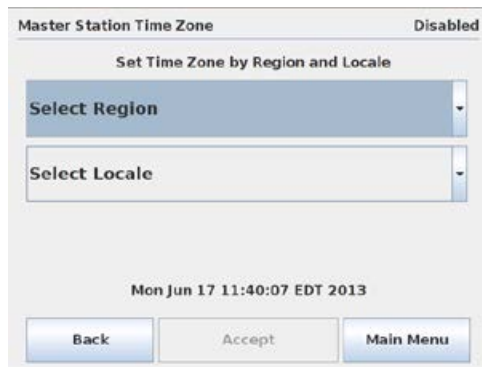
The Clock menu (Figure 8.6) allows the user to set the unit's clock parameters including the current time and enabling/disabling the use of a time server to retrieve the current time. If the time server option is enabled, the IP address field will become editable and can be used to indicate the desired server IP.

Figure 8.6 - Clock



Additionally, the Master Station Clock can be set to the correct local time zone by selecting the Time Zone button in the Clock screen. The time zone is configured by selecting the region and locale in which the Master Station is located.

Figure 8.7 - Time Zone



8.2.1.4 Screen Saver

The Screen Saver menu (Figure 8.8) allows the user to set the unit's screen saver parameters. The screen saver can be set to activate between one minute and 15 minutes after the last screen use. Alternatively, the screen saver can be disabled entirely.

Figure 8.8 - Screen Saver

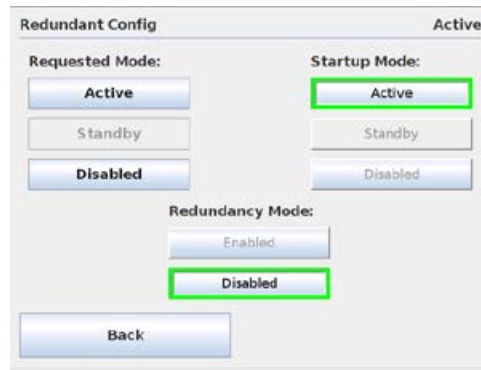


8.2.2 Redundant Configuration

The Configure Hot Standby screen (Figure 8.9) enables the user to configure the Master Station for Hot Standby operation. The requested mode and startup mode can be set to Active, Standby, or Disabled. Changes to the system configuration are only allowed when the Master Station is operating in Disabled mode in order to prevent adverse network problems. Most system configuration menus are disabled when the unit is operating in Active mode. In addition, if two modules are present, redundancy should be enabled to allow for Hot/Standby swapping.

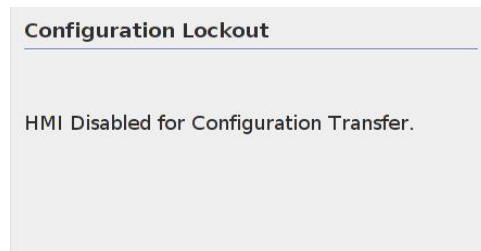
NOTE: If redundancy is disabled, Standby is not a valid option.

Figure 8.9 - Configure Hot Standby



When the Redundant Configuration is enabled and changes are saved in the Active unit, the two redundant units perform a configuration file transfer. During the configuration file sync, all user operation is disabled until the synchronization is finished. Once the Active unit is finished sending the files, operation is restored. The Standby unit operation is restored shortly after.

Figure 8.10 - Configuration Transfer Lockout



8.2.3 Change MOV Tags

This screen enables the user to set or modify MOV tag names. Simply select the desired MOV tag box and a keypad will appear. Use the keypad to assign a unique tag for the MOV by using letters and symbols for a descriptive tag with a maximum length of eight characters.

NOTE: The changing of MOV Tags is disabled when the unit is running in “Active” mode. To turn off “Active” mode and change the MOV Tags, go to the System Configuration menu as detailed in Section 8.1 and select the “Redundant Config” button. Under the Requested Mode title, select the “Disabled” button and tap the “Back” button to return to the System Configuration screen. MOV Tags can now be changed by tapping the “Change MOV Tags” button and following the directions as described in this section.

Figure 8.11 - Tag List



8.2.4 User Administration

The User Administration screen (Figure 8.12) is accessible when the user is logged in as an Administrator (see User Rights Overview in Section 1). It permits the addition or deletion of individual users, as well as the assignment of user passwords and roles within the Master Station.

NOTE: User Administration is disabled when the unit is running in “Active” mode. To turn off “Active” mode and make user administration changes, go to the System Configuration menu as detailed in Section 8.1 and select the “Redundant Config” button. Under the Requested Mode title, select the “Disabled” button and tap the “Back” button to return to the System Configuration screen. All the user administration operations can now be changed by tapping the “User Administration” button and following the proceeding directions.

Figure 8.12 - User Administration



8.2.4.1 Add New User

To add a new user to access the Master Station, tap the “Add User” button on the User Administration screen. The Master Station steps through a form of entering a username (Figure 8.13), password (Figure 8.14), confirming the password, and confirming the add user action. All new users default to ‘Viewer’ privileges (see User Rights Overview in Section 1) which can be changed later as detailed in Section 8.2.4.3 – User Settings. Once the new user account has been created the Master Station returns to the User Administration screen.

Figure 8.13 - Enter New Username



Figure 8.14 - Enter New Password



8.2.4.2 Delete User

To remove a user account from accessing the Master Station, tap the “Delete User” button on the User Administration screen. A listing of all the user accounts on the Master Station are displayed as demonstrated in Figure 8.15. Select a user account by tapping on the desired account and hit the “Delete User” button. A confirmation box will appear confirming the action. This action cannot be undone. Once the account has been deleted the Master Station returns to the User Administration screen.

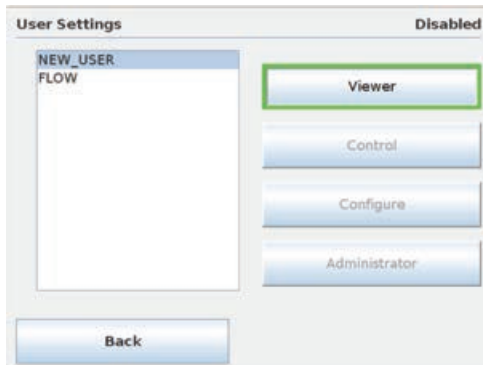
Figure 8.15 - Delete User



8.2.4.3 User Settings

To modify user privileges on the Master Station, tap the “User Settings” button on the User Administration screen. A listing of all the user accounts on the Master Station are displayed as demonstrated in Figure 8.16. Select a user account by tapping on the desired account and select the account access level for the user. A confirmation box will appear confirming the change. Once the user privilege has been changed the Master Station returns to the User Administration screen.

Figure 8.16 - User Settings



8.2.4.4 Change Password

To change a password for a user account, tap the “Change Password” button on the User administration screen. A listing of all the user accounts on the Master Station are displayed as demonstrated in Figure 8.17. Select a user account by tapping on the desired account and hit the “Change Password” button. A password entry form (see Figure 8.14) will open. Enter the account’s current password to be authenticated to make the change. Once the current password has been correctly entered the Master Station will ask for the new password (see Figure 8.18). Enter a new password for the user; confirm the password and the password change action. Once the password has been successfully changed, the Master Station will return to the User Administration screen.

Figure 8.17 - Change Password



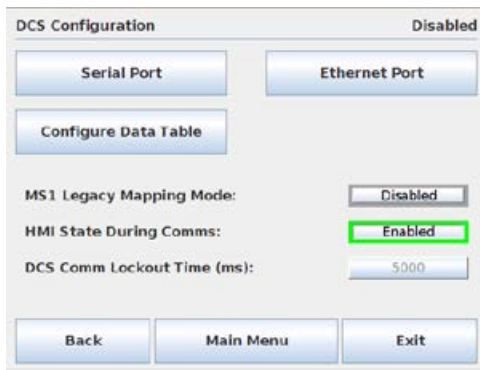
Figure 8.18 - Enter New Password



8.2.5 DCS Configuration

The DCS Configuration screen (Figure 8.19) allows the user to configure communication port parameters in order to successfully link the Master Station to the control system's Host device (DCS/ PLC/etc.). Furthermore, data registry mapping is accomplished by selecting the Configure Data Table button.

Figure 8.19 - DCS Configuration



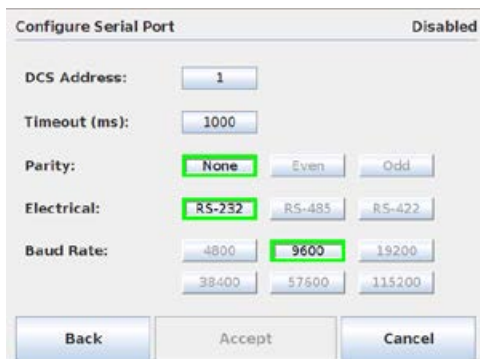
Different DCS Register mapping styles can be selected on the “DCS Configuration” screen. If needed, the MSIII can operate in legacy mapping (or A/B style mapping) mode depending on the DCS Host’s needs.

8.2.5.1 Serial Port

The DCS serial port on the rear of the Master Station III unit is configured via the Serial Port screen (Figure 8.20). Simply select appropriate settings for desired application, then save.

Settings available for DCS communication include: baud rate, parity, electrical standard, DCS address, timeout, RTS ON delay, and RTS OFF delay. Serial connection requires null modem cable/adaptor.

Figure 8.20 - Serial Port Configuration



DCS Address: DCS address of the Master Station III unit.

Timeout: Defines the maximum acceptable response delay time from the MSIII after request sent by Master.

Parity: Error checking option for serial communication.

Electrical: Serial standard interface.

Baud Rate: Communication rate in bits per second.

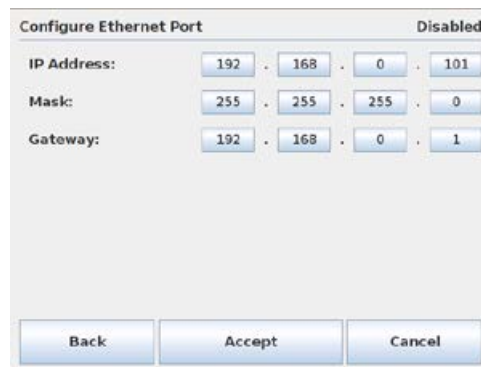
These values are dependent upon the message reply length as well as the poll rate.

8.2.5.2 Ethernet Port

The Ethernet port assigned to the control system’s Host device, is configured via the Configure Ethernet Port screen (Figure 8.21) to communicate via Modbus TCP/IP. Simply set the desired IP address, mask, and gateway and then save entries. Please note that each Master Station processing module must be configured with a unique IP address, mask, and gateway.

Touching each octet on the configuration screen will allow the user to enter the address.

Figure 8.21 - Configure Ethernet Port



NOTE: Use port 4502 for Modbus communications.

8.2.5.3 Configure Data Table

The Master Station data table is configurable for the Modbus Function codes 02, 03, 05/15, 06/16. The Modbus function code 01 has a fixed data table and does not permit user alteration. The data tables are edited by using the Configure DCS Data Table menu (Figure 8.22).

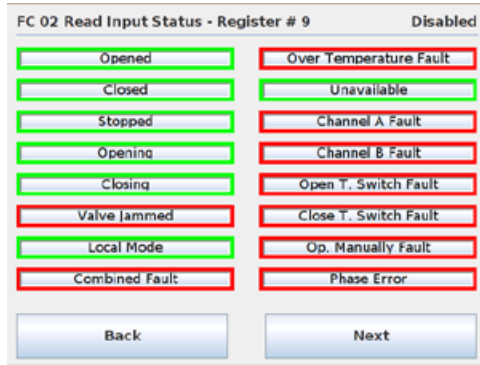
Figure 8.22 - Configure DCS Data Table



8.2.5.3.1 Modbus FC 02 Read Input Status

Touching the “Modbus FC 02 Read Input Status” button will take the user to the FC 02 Read Input Status Screen (Figure 8.23) for selection of desired input status bits from field unit holding registers 9-13. There are two ways of doing this: Standard and A/B Style. Standard style is a static mapping of register status bits as seen in Table 8.1. A/B Style is a dynamic mapping of register status bits as selected using the register tables based on Table 8.1. Choose the mapping style according to the expatiation in Section 8.2.5 DCS Configuration.

Figure 8.23 - FC-02 Read Input Status



Selecting the “Next” button will advance the screen from registers 9 through 13.

In standard mapping mode the Function Code -02 mapping is a static mapping of the total input table as shown in Table 8.1 per MOV. A total of 80 bits represent an individual MOV. The use of this function code will provide the user with the input status bits that are used to develop holding registers 9 through 13. Only the enabled bits will be returned as valid data (otherwise, zeros). Address affect is accounted for in MS III decoding process (i.e., 10,000). The A/B mapping style operates similarly but with the exception that only enabled bits return data. So where the Standard Style returns all bits, valid or not, A/B Style returns only the bits that are selected.

Table 8.1 - Status Bit Definitions

Bit Number	Modbus Bit Address	MX/DDC
129	128	Opened
130	129	Closed
131	130	Stopped in mid-travel
132	131	Opening
133	132	Closing
134	133	Valve jammed
135	134	Not in remote
136	135	Combined fault
137	136	Over-temperature fault
138	137	Actuator in Stop Mode
139	138	Channel A fault
140	139	Channel B fault
141	140	Open torque switch fault
142	141	Close torque switch fault
143	142	Valve operated manually fault
144	143	Phase error

Table 8.1 - Status Bit Definitions (continued)

Bit Number	Modbus Bit Address	MX/DDC
145	144	Open inhibit active
146	145	Close inhibit active
147	146	Not used
148	147	Not used
149	148	One or more phases is missing
150	149	Reverse phase sequence is occurring
151	150	ESD conflict
152	151	Inhibit conflict
153	152	Use in local/stop (input must be set for CSE and enabled)
154	153	Not used
155	154	Network emergency shutdown (ESD) is active
156	155	Local emergency shutdown is active
157	156	Field unit microprocessor has reset since the last poll
158	157	MX in stop move
159	158	Opening in local mode
160	159	Closing in local mode
161	160	Close contactor (interlocked)
162	161	Open contactor (interlocked)
163	162	S1 or R1 (opt)
164	163	S2 or R2 (opt)
165	164	R3 (opt)
166	165	R4 (opt)
167	166	R5 (opt)
168	167	R6 (opt)
169	168	R7 (opt)
170	169	Network relay
171	170	R8 (opt)
172	171	Not used
173-176	172-175	Mov series (0=1, A=9)
177	176	Remote switch
178	177	Thermal overload
179	178	Open torque switch
180	179	Open limit switch
181	180	Close torque switch
182	181	Close limit switch

Table 8.1 - Status Bit Definitions (continued)

Bit Number	Modbus Bit Address	MX/DDC
183	182	Not used
184	183	Not used
185	184	User Input 0
186	185	User Input 1
187	186	User Input 2
188	187	Remote stop input
189	188	Remote open input
190	189	Remote close input
191	190	Not used
192	191	Not used
193	192	Analog board 1 present
194	193	Analog board 2 present
195	194	Analog Input #1 lost
196	195	Analog Input #2 lost
197	196	Network Channels A/B timed out
198	197	Relay board R5-R8 present
199	198	DDC board present
200	199	Relay board R1-R4 and RM present
201	200	FF board present
202	201	PB PA board present
203	202	CLE assigned for input 2
204	203	DNET board present
205	204	Lost Phase Input
206	205	Phase Reverse Input
207	206	Not used
208	207	PB DP board present

From DCS, user must address the Master Station III and poll according to the FC-02 data table. See the following example of a request/response exchange between the DCS and the Master Station III using the Standard mapping scheme.

Example of read inputs command

Poll Master Station for 16 inputs starting at input 81 (i.e., field unit #2)

Query: 01020050001079D7

Response: 0102020408BABE

Table 8.2 - Function Code -02 Example Message Breakdown

Query		Response	
01	MSIII Unit Address	01	MSIII Unit Address
02	Function	02	Function
00	Starting Address Hi	02	Byte Count
50	Starting Address Lo	04 ¹	Data (Inputs 10088 - 10081; MOV2)
00	No. of Points Hi	08 ²	Data (Inputs 10096 - 10089; MOV2)
10	No. of Points Lo	BABE	Error Check (CRC)
79D7	Error Check (CRC)		

NOTE 1: 04h equals 0000 0100 (actuator stopped in mid-travel input bit is ON)

NOTE 2: 08h equals 0000 1000 (actuator Channel B fault input bit is ON)

8.2.5.3.2 Modbus FC 03 Read Holding Registers

Touching the “Modbus FC 03 Read Holding Registers” button will take the user to the Modbus Holding Registers screen (Figure 8.24) for selection of desired field unit holding registers 3-15. Note that registers 8 and 9 are always included in the data table.

Figure 8.24 - Modbus Holding Registers



Selecting the “Next” button will advance the screen to the following sample data table screen:

Figure 8.25 - FC-03 Sample Data Table

Data Table Modbus Function Code 03						Disabled
Reg. #	MOV #	Meaning	Reg. #	MOV #	Meaning	
40001	1	Pos	40011	3	Fault	
40002	1	Status	40012	3	D Out	
40003	1	Fault	40013	4	Pos	
40004	1	D Out	40014	4	Status	
40005	2	Pos	40015	4	Fault	
40006	2	Status	40016	4	D Out	
40007	2	Fault	40017	5	Pos	
40008	2	D Out	40018	5	Status	
40009	3	Pos	40019	5	Fault	
40010	3	Status	40020	5	D Out	

NOTE: Data table shown with only registers 8 and 9 (Position and Status) selected.

This function code is used to read the binary contents of holding registers. This function code is typically used during the network polling cycle. A network poll must consist of field unit registers 8 (Position) and 9 (Status) at a minimum. See Table 8.4 for a complete listing of the holding registers.

Example of read multiple registers command

Poll Master Station for 2 registers starting at register 27 (i.e., field unit #14)

Query: 0103001A0002E5CC

Response: 010304003200445BCF

Table 8.3 - Function Code -03 Example Message Breakdown

Query		Response	
01	MSIII Unit Address	01	MSIII Unit Address
03	Function	03	Function
00	Starting Address Hi	04	Byte Count
1A	Starting Address Lo	00	Data Hi (Register 40027; MOV14)
00	No. of Points Hi	32 ¹	Data Lo (Register 40027; MOV14)
02	No. of Points Lo	00	Data Hi (Register 40028; MOV14)
E5CC	Error Check (CRC)	44 ²	Data Lo (Register 40028; MOV14)
		5BCF	Error Check (CRC)

NOTE 1: 0032h equals 50 decimal (actuator position in percent format)

NOTE 2: 0044h equals 68 decimal or 0000 0000 0100 0100 (actuator stopped between limits in local mode)

Table 8.4 - Register Definitions

Register #	Description	Meaning
1	Command	Registers 1 and 2 are write-only registers used for Modbus Function Code 06
2	Argument	Registers 1 and 2 are write-only registers used for Modbus Function Code 06
3	Analog Output 1	Position (APT) Value (Default 0-100) ¹
4	Analog Output 2	Torque (ATT) ⁵ Value (Default 0-100) ¹
5	Analog Input	Main Power (Volts)
6	Analog Input	Analog Input 1 (Default 0-100) ¹ User 4-20 mA / 0-20 mA Input
7	Analog Input	Analog Input 2 (Default 0-100) ¹ User 4-20 mA / 0-20 mA Input
8	Position	Valve Position, Scaled Value (Default 0-100) ¹
9	Status Register	16 Bits of field unit status: Bit 0 Opened Bit 1 Closed Bit 2 Stopped in Mid-Travel Bit 3 Opening Bit 4 Closing Bit 5 Valve jammed Bit 6 Not in Remote ² Bit 7 Combined fault ³ Bit 8 Over temperature fault Bit 9 Future Implementation Bit 10 Network Channel A fault ⁴ (Terminals 13 and 14) Bit 11 Network Channel B fault ⁴ (Terminals 5 and 4) Bit 12 Open torque switch fault Bit 13 Close torque switch fault Bit 14 Valve-operated manually fault Bit 15 Phase error

NOTE 1: Default value is scaled 0-100 of span. Changes made to “Analog Scale” affect analog registers (3, 4, 6, 7, 8) and “move-to” commands. (0-100, 0-255, 0-4095)

NOTE 2: MX/DDC actuators shipped after 2nd QTR, 1999, have the following definition of Register 9 Bit 6. When this bit has a value of 1 or true, the actuator is in LOCAL or STOP (unavailable for network control). The actuator selector switch in REMOTE (available for network control) is indicated by Register 12 Bit 0 having a value of 1 or true.

IMPORTANT: Verify host program when installing an MX/DDC actuator shipped after 2nd QTR, 1999, on a network commissioned before 2nd QTR, 1999, for proper indication of selector switch values. Failure to verify proper selector switch indication at the host may cause unsafe conditions at the facility.

MX/DDC actuators shipped prior to 2nd QTR, 1999, have the following definition for Register 9 Bit 6. When this bit has a value of 1 or true, the actuator selector switch is in LOCAL mode. This bit does not indicate STOP or REMOTE. The actuator selector switch in REMOTE (available for network control) is indicated by Register 12 Bit 0 having a value of 1 or true. Register 9 Bit 6 value 0 (zero) or false AND Register 12 Bit 0 value 0 (zero) or false indicates selector switch is in the STOP position.

NOTE 3: Combined Fault bit is high when Bit 5 or 8 or 9 or 15 or (Bits 10 and 11) is high.

NOTE 4: Channel A is physical connection A1. Channel B is physical connection A2.

NOTE 5: The ATT feature will calculate the percent of torque seen with respect to the configured unit torque setting. This percent torque value will be reflected in modbus register 3, when configured for Analog Out 1, and modbus register 4, when configured for Analog Out 2. Example: If the unit torque setting is 75%, the modbus register will be populated with a percent torque value scaled from 0% to 75% of the unit-rated torque.

Table 8.4 - Register Definitions (continued)

Register #	Description	Meaning
10	Fault Register	16 Bits of field status Bit 0 Open inhibit active Bit 1 Close inhibit active Bit 2 Not Used Bit 3 Not Used Bit 4 One or more phases are missing Bit 5 Reverse phase sequence is occurring Bit 6 ESD conflict Bit 7 Inhibit conflict Bit 8 CSE in local/stop (input must be set for CSE and enabled) Bit 9 Not Used Bit 10 Network emergency shutdown is active Bit 11 Local PB emergency shutdown is active Bit 12 Field unit microprocessor has reset since the last poll Bit 13 MX in stop mode Bit 14 Opening in local mode Bit 15 Closing in local mode
11	Digital Outputs	Value of 16 Digital Outputs Bit 0 Close contactor (Interlocked) Bit 1 Open contactor (Interlocked) Bit 2 S1 or R1 (Opt) Bit 3 S2 or R2 (Opt) Bit 4 R3 (Opt) Bit 5 R4 (Opt) Bit 6 R5 (Opt) Bit 7 R6 (Opt) Bit 8 R7 (Opt) Bit 9 Network Relay Bit 10 R8 (Opt) Bit 11 Not Used BIT 12-15 MOV Series (MX = 1, MXa = 9, QX = 6, UEC-3 = 0, UEX = 10)
12	Digital Inputs 1	Value of 16 Digital Inputs Bit 0 Remote Switch Bit 1 Thermal Overload Bit 2 Open Torque Switch Bit 3 Open Limit Switch Bit 4 Close Torque Switch Bit 5 Close Limit Switch Bit 6 Not Used Bit 7 Not Used Bit 8 User Input 0 (Default=ESD), Terminal 30 Bit 9 User Input 1 (Default=Open Inhibit), Terminal 34 Bit 10 User Input 2 (Default=Close Inhibit), Terminal 35 Bit 11 Remote Stop Input, Terminal 26 Bit 12 Remote Open Input, Terminal 25 Bit 13 Remote Close Input, Terminal 27 Bits 14-15 Not Used

Table 8.4 - Register Definitions (continued)

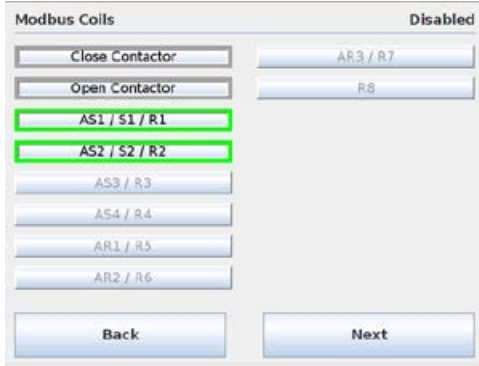
Register #	Description	Meaning
13	Digital Inputs 2	Value of 16 Digital Inputs Bit 0 Analog board 1 present Bit 1 Analog board 2 present Bit 2 Analog Input 1 lost Bit 3 Analog Input 2 lost Bit 4 Network Channels A/B timed out Bit 5 Relay board R5-R8 present Bit 6 DDC board present Bit 7 Relay board R1-R4 and RM present Bit 8 Foundation Fieldbus board present Bit 9 Profibus PA board present Bit 10 CSE chosen for input 2 Bit 11 DeviceNet board present Bit 12 Phase lost Bit 13 Phase reverse Bit 14 Not Used Bit 15 Profibus DP board present
14	Compartment Temp	Internal compartment temperature ¹
15	Torque	Torque Value (0-100% unit rating)
16	Current State	Bits 0-15 Not Used
17	Field Unit Holding Register	Special Applications Only
18	Field Unit Holding Register	Special Applications Only
19	Field Unit Holding Register	Special Applications Only
20	Field Unit Holding Register	Special Applications Only
21	Field Unit Holding Register	Special Applications Only
22	Field Unit Holding Register	Special Applications Only
23	Field Unit Holding Register	Special Applications Only
24-44	Reserved	Special Applications Only
45-47	Not Named	Special Applications Only
48	TP_START_POSITION	Special Applications Only
49	TP_STOP_POSITION	Special Applications Only
50	TP_SAMPLE	Special Applications Only
51	TP_MID_T_HIGH	Special Torque Applications Only
52	TP_MID_T_POS	Special Applications Only
53	TP_MID_T_AV_VAL	Special Torque Applications Only
54	TP_STOP_VAL	Special Applications Only
55	TP_BEFORE_MID_T_HIGH	Special Torque Applications Only
56	TP_AFTER_MID_T_HIGH	Special Torque Applications Only

Note 1: Range is +90°C to -55°C. High byte 00 indicates positive (+) and 01 indicates negative (-). Low byte indicates temperature value.

8.2.5.3.3 Modbus FC 05/15 Force Coils

Touching the “Modbus FC 05/15 Force Coils” button will take the user to the Modbus Coils screen (Figure 8.26) for selection of desired field unit coils. Note that the Close and Open Contactor coils are always included in the data table.

Figure 8.26 - Modbus Coils



Selecting the “Next” button will advance the screen to the sample data table screen shown below:

Figure 8.27 - FC-05/15 Sample Data Table

Data Table Modbus Function Code 05			Disabled		
Reg. #	MOV #	Meaning	Reg. #	MOV #	Meaning
0001	1	Close	0011	3	S1/R1
0002	1	Open	0012	3	S2/R2
0003	1	S1/R1	0013	4	Close
0004	1	S2/R2	0014	4	Open
0005	2	Close	0015	4	S1/R1
0006	2	Open	0016	4	S2/R2
0007	2	S1/R1	0017	5	Close
0008	2	S2/R2	0018	5	Open
0009	3	Close	0019	5	S1/R1
0010	3	Open	0020	5	S2/R2

Back

NOTE: Table shown with Open and Close Contactors, S1/R1 and S2/R2 Coils selected.

Function code -05 is used to force a single coil. Forcing the individual coil either ON (1) or OFF (0) will energize or de-energize a coil (digital output). Coil 1 in the field unit closes the actuator and Coil 2 opens the actuator. If the actuator is opening or closing, changing the status of coil 1 or 2 from a value of 1 to 0 will stop the actuator (the coil will automatically be set to zero when the actuator reaches the full open or full close position).

For function code -15 it should be noted that the coils are operated from the lowest coil number to the highest. Forcing coil 1 or 2 OFF (0) is considered a stop command, sending a 15 command to force two coils starting with coil 1, with coil 1 ON and coil 2 OFF, would result in the unit stopping, since coil 2 is forced OFF after coil 1 is forced ON. To prevent inadvertent stop commands from being issued, it is recommended to force one coil at a time.

Available digital outputs are listed in Table 8.5. Force-coil commands should be issued only once for the desired field unit control. Repeated issuance of an acknowledged command will degrade network performance.

NOTE: See LMENIM2329, Installation and Operation and Maintenance Manual for MX/DDC-100 Field Unit to configure AS and AR Relays for DDC control.

Table 8.5 - DDC-100 Coil Assignments, Modbus 05 Command Usage for Digital Outputs

Coil Number	Bit Number	Function
1	00	Close/Stop
2	01	Open/Stop
3	02	S1 or R1 (Opt) Latched
4	03	S2 or R2 (Opt) Latched
5	04	R3 (Opt) Latched
6	05	R4 (Opt) Latched
7	06	R5 (Opt) Latched
8	07	R6 (Opt) Latched
9	08	R7 (Opt) Latched
10	09	R8 (Opt) Latched

The normal response to the (05) command is an echo of the command.

From DCS, user must address the Master Station III and poll according to the table given in the FC -05 configuration. See the following example of a request/response exchange between the DCS and MSIII.

Example of force coil command

Force coil 17 of Master Station ON (This will close the valve controlled by field unit 5)

Query: 01050010FF008DFF

Response: 01050010FF008DFF

Table 8.6 - Function Code -05 Example Message Breakdown

Query		Response	
01	MSIII Unit Address	01	MSIII Unit Address
05	Function	05	Function
00	Coil Address Hi	00	Coil Address Hi (Coil 17; MOV5)
10 ¹	Coil Address Lo	10	Coil Address Lo (Coil 17; MOV5)
FF	Force Data Hi	FF	Force Data Hi
00 ²	Force Data Lo	00	Force Data Lo
8DFF	Error Check (CRC)	8DFF	Error Check (CRC)

NOTE 1: 0010h equals coil address 0001 0001b (field unit 5, coil 1)

NOTE 2: FF00h requests the coil to be ON (0000h requests the coil to be OFF)

Example of force multiple coils command

Force coil 2 of field unit 23 ON. This will CLOSE the valve controlled by field unit 23. Additionally, force coil 1 of field unit 24 ON. This will OPEN the valve controlled by field unit 24.

Query: 010F002D000201033290

Response: 010F002D00024403

Table 8.7 - Function Code -15 Example Message Breakdown

Query		Response	
01	MSIII Unit Address	01	MSIII Unit Address
0F	Function	0F	Function
00	Coil Address Hi	00	Coil Address Hi (Coil 46; MOV23)
2D	Coil Address Lo	2D	Coil Address Lo (Coil 46; MOV23)
00	Quantity of Coils Hi	00	Quantity of Coils Hi
02	Quantity of Coils Lo	02	Quantity of Coils Lo
01	Byte Count	4403	Error Check (CRC)
03	Force Data Lo		
3290	Error Check (CRC)		

NOTE 1: 002D00020103h equals coil addresses 00101101b (field unit 23, coil 2) and 00101110b (field unit 24, coil 1)

8.2.5.3.4 Modbus FC 06/16 Preset Registers

Touching the “Modbus FC 06/16 Preset Registers” button will take the user to the Modbus Holding Registers screen (Figure 8.28) for configuration of desired number of holding registers to be written per MOV. The 06 command presets a value into a single-holding register (Figure 8.28), while the 16 command presets a value into a block of multiple holding registers (Figure 8.29). The data table for these function codes permit either one or two write registers per field unit.

Figure 8.28 - Modbus Holding Registers-One Per MOV

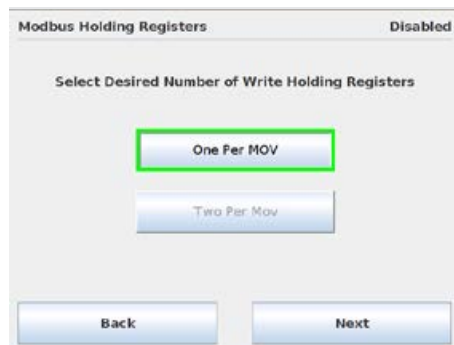
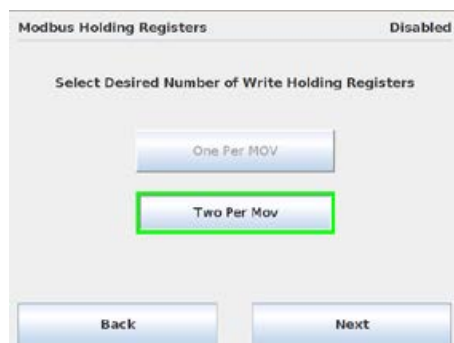


Figure 8.29 - Modbus Holding Registers-Two Per MOV



Selecting the “Next” button will advance the screen to a sample data table screen as shown below. Please note that a unique data table is created starting at register 45001. Specific field unit registry convention is as follows: DCS Command Write Register = [(MOV address -1) * (selected number of registers per MOV)] + 45001. Address affect is accounted for in MSIII decoding process (i.e., 40,000).

Figure 8.30 - FC-06/16 Sample Data Table with ‘One Per MOV’ selected

Data Table Modbus Function Code 06			Disabled		
Reg. #	MOV #	Meaning	Reg. #	MOV #	Meaning
45001	1	CMD	45011	11	CMD
45002	2	CMD	45012	12	CMD
45003	3	CMD	45013	13	CMD
45004	4	CMD	45014	14	CMD
45005	5	CMD	45015	15	CMD
45006	6	CMD	45016	16	CMD
45007	7	CMD	45017	17	CMD
45008	8	CMD	45018	18	CMD
45009	9	CMD	45019	19	CMD
45010	10	CMD	45020	20	CMD

Back

Figure 8.31 - FC-06/16 Sample Data Table with ‘Two Per MOV’ selected

Data Table Modbus Function Code 06			Disabled		
Reg. #	MOV #	Meaning	Reg. #	MOV #	Meaning
45001	1	CMD	45011	6	CMD
45002	1	ARG	45012	6	ARG
45003	2	CMD	45013	7	CMD
45004	2	ARG	45014	7	ARG
45005	3	CMD	45015	8	CMD
45006	3	ARG	45016	8	ARG
45007	4	CMD	45017	9	CMD
45008	4	ARG	45018	9	ARG
45009	5	CMD	45019	10	CMD
45010	5	ARG	45020	10	ARG

Back

These function codes are typically used to command Limitorque Modbus field units by writing values directly into command/argument registers. A predetermined value may be used to open/stop/close the actuator, move the actuator to a preset position, activate/deactivate network ESD, reset the field unit, etc. See the following example of a request/response exchange between the DCS and MSIII.

Write register commands should be issued only once for the desired field unit control. Repeated issuance of an acknowledged command will degrade network performance.

Example of a single register write command

Field Unit Command. Start a network ESD operation to field unit number 101. This corresponds to writing the value 1280 to register 45201.

Query: 0106145005008F7B

Response: 0106145005008F7B

Table 8.8 - Function Code -06 First Command Message Breakdown

Query		Response	
01	MSIII Unit Address	01	MSIII Unit Address
06	Function	06	Function
14	Register Address Hi	14	Register Address Hi (Register 45201; MOV101)

50 ¹	Register Address Lo	50	Register Address Lo (Register 45201; MOV101)
05	Force Data Hi	05	Force Data Hi
00 ²	Force Data Lo	00	Force Data Lo
8F7B	Error Check (CRC)	8F7B	Error Check (CRC)

NOTE 1: 1450h equals register address 45201 (field unit 101 command register)

NOTE 2: 0500h requests the register to be preset with 1280d (Start Network ESD)

Example of a two-command write to a single register

“Move-To” Command. Move an actuator at address 45 to 42% open by first writing the value of 42 to register 45090. After receiving a response, write the value of 6656 to register 45089. The actuator will then move to a position of 42% open. First Command:

Query: 010613E2002AACA7

Response: 010613E2002AACA7

Table 8.9 - Function Code -06 Second Command Message Breakdown

Query		Response	
01	MSIII Unit Address	01	MSIII Unit Address
06	Function	06	Function
13	Register Address Hi	13	Register Address Hi (Register 45090; MOV45)
E2 ¹	Register Address Lo	E2	Register Address Lo (Register 45090; MOV45)
00	Force Data Hi	00	Force Data Hi
2A ²	Force Data Lo	2A	Force Data Lo
ACA7	Error Check (CRC)	ACA7	Error Check (CRC)

NOTE 1: 13E2h equals register address 45090 (field unit 45 argument register)

NOTE 2: 002Ah equals 42d

Second Command:

Query: 010613E11A00D618

Response: 010613E11A00D618

Table 8.10 - Function Code -06 Message Breakdown

Query		Response	
01	MSIII Unit Address	01	MSIII Unit Address
06	Function	06	Function
13	Register Address Hi	13	Register Address Hi (Register 45089; MOV45)
E2 ¹	Register Address Lo	E2	Register Address Lo (Register 45089; MOV45)
1A	Force Data Hi	1A	Force Data Hi
00 ²	Force Data Lo	00	Force Data Lo
D618	Error Check (CRC)	D618	Error Check (CRC)

NOTE 1: 13E1h equals register address 45089 (field unit 45 command register)

NOTE 2: 1A00h equals 6656d

Example of multiple register write command

Write the command to close an actuator to field units 50, 51, and 52. This corresponds to writing the value 768 into command registers 45050, 45051, and 45052.

Query: 011013B90003060300030003006ABB

Response: 011003B900035569

Table 8.11 - Function Code -16 Message Breakdown

Query		Response	
01	MSIII Unit Address	01	MSIII Unit Address
10	Function	10	Function
13	Starting Address Hi	13	Starting Address Hi (Register 45050; MOV50)
B9 ¹	Starting Address Lo	B9	Starting Address Lo (Register 45050; MOV50)
00	Number of Registers Hi	00	Number of Registers Hi
03	Number of Registers Lo	03	Number of Registers Lo
06	Byte Count	5569	Error Check (CRC)
03	Preset Data Hi (MOV 50)		
00 ²	Preset Data Lo (MOV 50)		
03	Preset Data Hi (MOV 51)		
00	Preset Data Lo (MOV 51)		
03	Preset Data Hi (MOV 52)		
00	Preset Data Lo (MOV 52)		
6ABB	Error Check (CRC)		

NOTE 1: 13B9h equals register address 45050 (field unit 50 command register)

NOTE 2: 0300h requests the register to be preset with 768d (Field unit close)

See Tables 8.12 and 8.13 for valid register operations. For further reference, see DDC (Modbus) Field Unit Installation and Maintenance manual LMENIM2329.

Table 8.12 - Valid Command Register Operations

Host Commands to Field Unit Register 1	Value (Decimal)	Function
Null Command	0	No action
Open	256	Open actuator
Stop	512	Stop actuator
Close	768	Close actuator
Reset Field Unit	1024	Reset processor
Start Network ESD	1280	ESD initiate
Stop Network ESD	1536	ESD terminate
Engage Relay #1	2304	S1 or R1 (opt)
Engage Relay #2	2560	S2 or R2 (opt)
Engage Relay #3	2816	R3 (opt)
Engage Relay #4	3072	R4 (opt)
Engage Relay #5	3328	R5 (opt)
Engage Relay #6	3584	R6 (opt)
Engage Relay #7	3840	R7 (opt)
Disengage Relay #1	4352	S1 or R1 (opt)
Disengage Relay #2	4608	S2 or R2 (opt)
Disengage Relay #3	4864	R3 (opt)
Disengage Relay #4	5120	R4 (opt)
Disengage Relay #5	5376	R5 (opt)
Disengage Relay #6	5632	R6 (opt)
Disengage Relay #7	5888	R7 (opt)
Move-To (Enable) ¹	6656	Initiates “move-to”
Engage Relay #8	6912	R8 (opt)
Disengage Relay #8	7168	R8 (opt)

Note 1: This is a two-step command. A valid value must be written to Register 2 before issuing this command.

Other registers may also be preset to control or change other functions but care must always be taken to properly change these values. An improper value written to a register can cause undesirable actions from the DDC-100 Field Unit.

NOTE: Null Command–The field unit takes no action when this command is received. This command is typically used by a Host to reset the Host output register when required.

From DCS, user must address the Master Station III and poll according to the table given in the FC-06/16 configuration.

This command allows a Host to issue the “move-to” command with a single write utilizing the Modbus function code 06. Register 1 will be used to complete this command.

Rules for utilizing this command:

- Field unit scaling must be configured for 0-100.
- To use the hexadecimal method of determining a single write “move-to” command, 0x4B is always placed into the Hi Byte of Register 1. The desired position value is always placed into the Lo Byte of Register 1.
- To move the actuator to a position of 50%, place the value 0x4B in the high byte and the value of 0x32 (50 decimal) into the low byte.

Example:

Hex format: 0x4B32

To use the decimal method of determining a single write “move-to” command, add the desired position value to 19200.

Example:

Desired position: 50%

$$19200 + 50 = 19250$$

“19200 + Value” (Position Value for units capable of commands accepting 1 write “move-to”)

Table 8.13 - Valid Argument Register Operations

Values	Function
0 – 100	Desired Valve Position

8.2.6 MOV Network Config

The MOV Network Config screen (Figure 8.32) provides access to communication parameters essential for connecting the Master Station to all assigned field units. By selecting the Next button, the screen will advance to Active MOVs display (Figure 8.33) which allows the user to add additional field units to the network. After finishing the MOV activations desired, simply select the Poll Priority tab to advance to the Polling Priority view (Figure 8.34). This screen enables the user to set the poll cycle interval for each activated MOV. After the MOV network has been configured, please save the settings under the System Configuration screen (Figure 8.2).

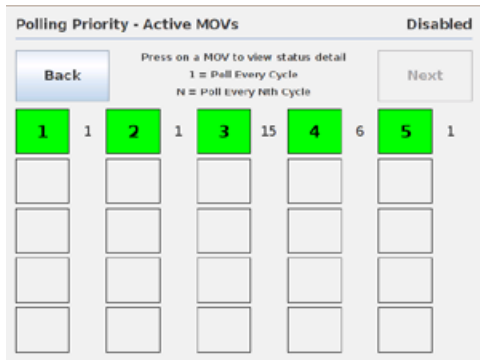
NOTE: MOV Network Config is disabled when the unit is running in “Active” mode. To turn off “Active” mode and make changes to the MOV Network configuration, go to the System Configuration menu as detailed in Section 8.1 and select the “Redundant Config” button. Under the Requested Mode title, select the “Disabled” button and tap the “Back” button to return to the System Configuration screen. All the MOV Network configuration changes can now be accessed by tapping the “MOV Network Config” button and following the proceeding directions.

Figure 8.32 - MOV Network Configuration

NOTE: The timeout and prop delay settings may need to be adjusted based on the actuator series, size of the network, baud rate, and cable type/length.

Figure 8.33 - Active MOVs

Figure 8.34 - Polling Priority-Active MOVs



In order to optimize the network efficiency, lower priority MOVs can be set to be polled at a user defined cycle.

8.2.7 File Manager

The File Manager screen (Figure 8.35) allows the user to import/load/export the Master Station configuration file, export the event log, and import the MOV tag name files. In addition, the user can update the unit's software version via this menu and restore the configuration settings back to factory default. These actions in detail consist of:

Import Config File: enables the user to import an existing system configuration file from a connected USB Flash Drive.

Import Tag File: enables the user to import a spreadsheet to the Master Station's tag configuration settings.

Load Config File: enables the user to import a saved system configuration file from system memory.

Export Config File: enables the user to save the configuration file to a connected USB Flash Drive.

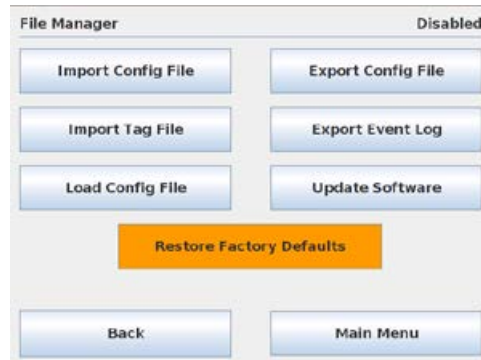
Export Event Log: enables the user to save the Master Station event log to a connected USB Flash Drive.

Update Software: enables the user to update the system software through a connected USB Flash Drive with a software update file.

Restore Factory Defaults: enables the user to revert all system changes back to the original factory settings the Master Station was shipped with.

NOTE: File Manager is disabled when the unit is running in “Active” mode. To turn off “Active” mode and access the File Manager, go to the System Configuration menu as detailed in Section 8.1 and select the “Redundant Config” button. Under the Requested Mode title, select the “Disabled” button and tap the “Back” button to return to the System Configuration screen. All the File Manager operations can now be changed by tapping the “File Manager” button and following the proceeding directions.

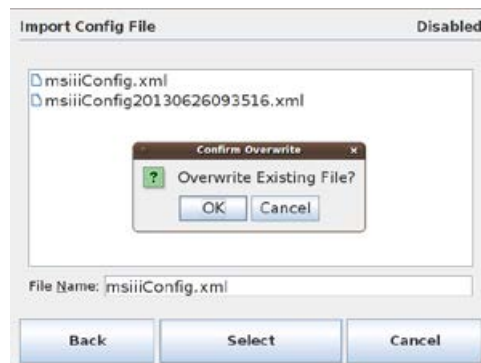
Figure 8.35 - File Manager



8.2.8.1 Import Config File

The Import Config File screen (Figure 8.36) allows the user to access the file chooser and select a configuration file to be copied from a connected USB Flash Drive to the default directory for the Config File archives. The Master Station’s existing configuration file is overwritten with the new, imported file.

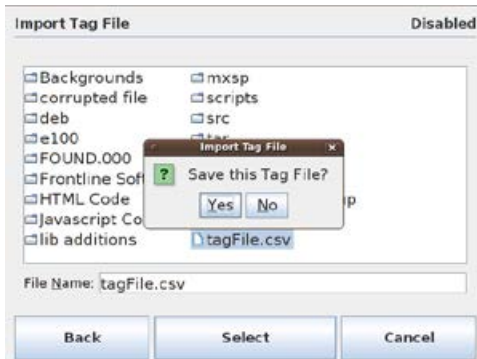
Figure 8.36 - Import Config File



8.2.8.2 Import Tag File

The Import Tag File screen (Figure 8.37) allows the user to access the file chooser and select an MOV tag name file from a connected USB Flash Drive to be loaded into the Master Station's MOV tag configuration settings. The Master Station supports .csv type files with MOV numbers in the first column and corresponding tag names in the second column. MOV tag names should be eight characters or less in order to display properly.

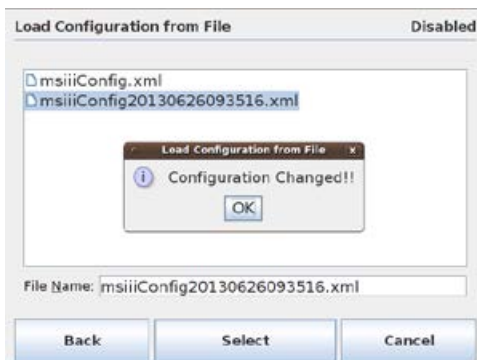
Figure 8.37 - Import Tag File



8.2.8.3 Load Config File

When the system configuration file is changed, the Master Station keeps a copy of the old configuration and saves it to system memory. The Load Config File screen (Figure 8.38) allows the user to load the configuration from an existing file that was saved in memory.

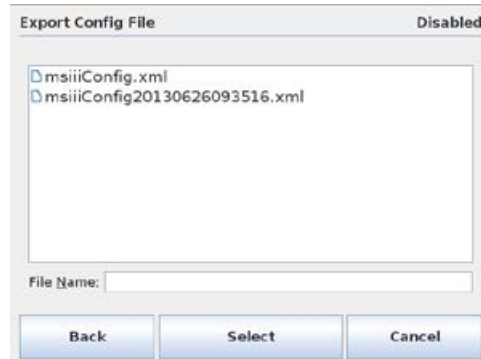
Figure 8.38 - Load Configuration from File



8.2.8.4 Export Config File

The Export Configuration screen (Figure 8.39) enables the user to access the file chooser and save a selected configuration file to a connected USB Flash Drive.

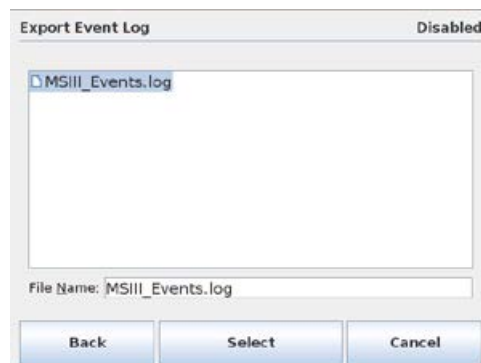
Figure 8.39 - Export Config File



8.2.8.5 Export Event Log

The Export Event Log screen (Figure 8.40) permits the saving of diagnostic events. Each event is related to changes in log-in Information, configuration, network status, or MOV status polling activity. In addition, all captured events are defined, numbered, and time-stamped in order to maintain the logged data.

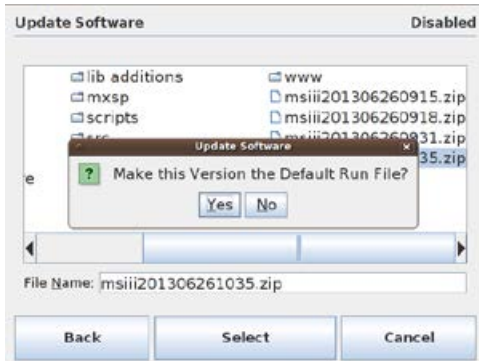
Figure 8.40 - Export Event Log



8.2.8.6 Update Software

The Import Software Update screen (Figure 8.41) allows the user to access the file chooser and select a software update file to be copied to the default directory for the Master Station device software file archives.

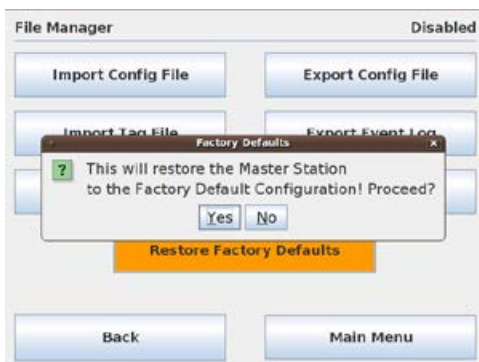
Figure 8.41 - Update Software



8.2.8.7 Restore Factory Defaults

To return the Master Station configuration setting to the factory default settings it was originally shipped with, tap the orange Restore Factory Defaults button at the bottom of the File Manager page. To avoid an administrator accidentally losing all changes, a confirmation popup box appears to confirm the action.

Figure 8.42 - Restore Factory Defaults

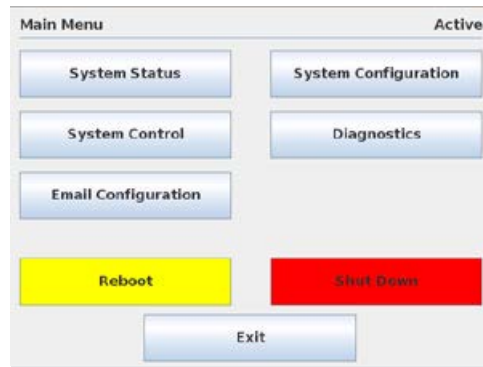


9 Diagnostics

9.1 Main Menu

Upon successful login as a user assigned to either Configure or Administrator role level, the Diagnostics button on the Main Menu screen will be present (Figure 9.1). Simply touching the Diagnostics button will advance the HMI display to the Diagnostics screen (Figure 9.2). By selecting Exit, the user will end the session and log out.

Figure 9.1 - Main Menu



9.2 Diagnostics

The Diagnostics screen (Figure 9.2) provides the user with accessibility to three core areas of MOV network data collection. The user may select the Event Log, Communication/Function Code Logger, or Polling Statistics tab to acquire data related to the respective diagnostic feature. To improve on MSIII Network and DCS performance, logging features can be turned off.

Logger screen shows configuration changes related to channel A and/or B, Ethernet, and DCS port activity, as well as individual function codes.

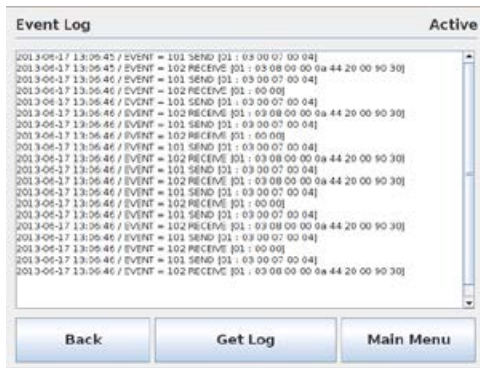
Figure 9.2 - Diagnostics



9.2.1 Event Log

The Event Log screen (Figure 9.3) allows the user to display the last 20 events that occurred. Each event is related to changes in login Information, configuration, network status, or MOV polling activity. Every entry is defined, numbered, and time-stamped in order to maintain the logged data.

Figure 9.3 - Event Log

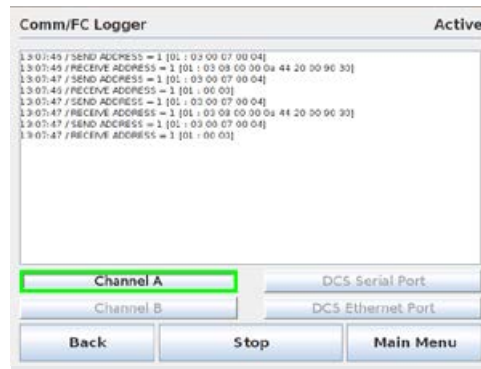


9.2.2 Comm/FC Logger

The Comm/FC Logger (Figure 9.4) captures Modbus requests and responses to/from the DCS and MOVs (channel A & B). Additionally, the Logger screen shows configuration changes related to channel A and/or B, Ethernet, and DCS port activity, as well as individual function codes. The channels can be selected individually to filter activity being displayed.

NOTE: The Comm/FC logger is designed for local diagnostic purposes only. While the Comm/FC logger is active, communication from the DCS/host device to the Master Station III is subject to reduced performance.

Figure 9.4 - Comm/FC Logger



9.2.3 Polling Statistics

The Polling Statistics screen (Figure 9.5) allows the user to view the polling history of each activated MOV on the network. This diagnostic feature reveals the total number of polls, errors encountered, and error rate (%) during a user-defined time frame.

Figure 9.5 - Polling Statistics



10

Troubleshooting Guide

10.1 Front Panel Indicators

There are four LEDs on the front of the Master Station that provide a visual reference of the overall health of the Master Station and MOV network. These LEDs are described as follows:

- A. Battery - An orange LED indicated that the unit is operating on internal battery power.
- B. Network Alarm - A red LED indicates a field network communication fault.
- C. MOV Alarm - A red LED indicates an MOV device alarm is present.
- D. Power - A green LED indicates that the unit has power.

10.2 Network Status Screen

The Network Status screen provides a visual reference of the overall health of the MOV network. See Section 5 for instructions on viewing the MOV and communication channel status. MOV faults can be examined by clicking on the desired unit. Communication channel faults can be examined and corrected by reviewing log files (see Section 9), verifying correct configuration parameters (see Section 8), and checking wiring connections and/or network surge protection module on rear of unit.

10.3 Blank Display

A blank display can be the result of the activated screen saver feature. If setting adjustments are required, please see Section 8. Additionally, the lack of AC/DC power to the Master Station will also cause a blank screen. After verifying power is available to the unit, disconnect the power and check the power fuse on the rear of the unit. If it is good, remove the power surge protection module and check for continuity.

10.4 Error Messages

Problem Saving File – Media Error (Full, Write Protected, Corrupted)

No USB Device Selected - Configuration save attempted without a USB device inserted in a USB port, and selected.

Error Adding User - Duplicate User entry

Error Saving To Config File - Media Error (Full, Write Protected, Corrupted)

10.5 Network Communication

10.5.1 DCS communication via RS-232/422/485

Unable to establish comm's with the DCS

- a. Confirm null modem cable connection, if using RS-232
- b. Verify DCS address setting
- c. Verify baud rate, handshaking, start bit settings
- d. Check host system settings
- e. Test the cable, replace if defective

10.5.2 DCS communication via Modbus TCP/IP

Unable to establish comm's with the DCS

- a. Confirm IP address settings
- b. In command mode, ping the MSIII, if no response, verify the MSIII and the host are on the same network
- c. Verify Ethernet path from host to the MSIII

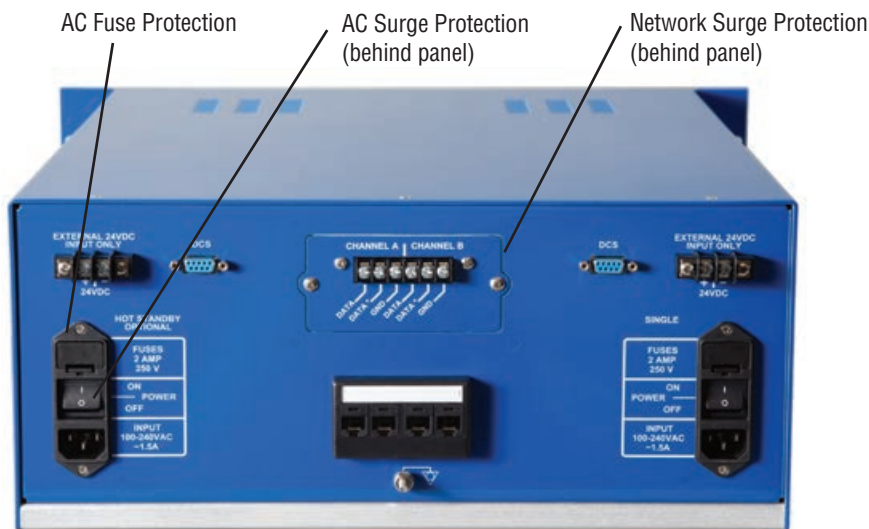
10.5.3 MSIII communication to the MOV network

Unable to establish comm's with the MOV's

- a. Confirm proper cable connections on the first MOV in the loop and the MSIII. RS-485 is polarity sensitive
- b. Confirm RS-485 baud rate settings match MOV baud rate settings
- c. Confirm MSIII is configured for Modbus RTU mode
- d. Verify timing settings (timeout, prop delay, RTS on delay)

10.6 Surge Protection

Figure 10.1 - Surge Protection Access



10.6.1 AC Surge Protection

It is recommended to replace the surge protector if a known primary AC power surge has occurred. For a Hot Standby unit, please ensure that both main AC surge protectors are replaced. Follow the below procedure to ensure proper replacement.

Figure 10.2 - Main AC Power Input Module



Remove two screws on the main AC power input module and then remove the module from the chassis.

Figure 10.3 - Removing Main AC Input Power Module



Locate the AC surge protector, unplug wiring connector on both sides of the protector, and remove it from the cable assembly.

Figure 10.4 - AC Surge Protector



Install replacement protector by following above procedures in reverse order.

10.6.2 AC Fuse Protection

Release clip on bottom of the fuse holder and gently remove holder from main AC power input module.

Figure 10.5 - Removing Fuse Holder



Figure 10.6 - AC Fuse Holder



Check each of the two fuses, located in the holder, for continuity. Replace if necessary and reinstall the holder into the module.

10.6.3 Network Surge Protection

The network surge protector is a three-stage device for protection of the RS-485 data lines. Loss of communication on either channel A or B could result in a faulty surge protector. Please see below traces to verify proper operation of the protector.

Figure 10.7 - Network Surge Protector



If faulty, please replace device by removing the two outer screws and then the assembly. Replace with a new protector assembly.

Figure 10.8 - Removing Network Surge Protector





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