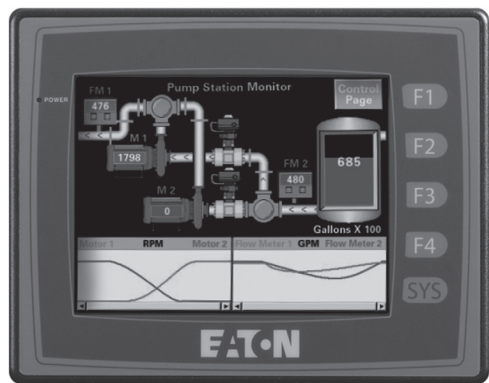


How to control and monitor up to 16 Motor Insight motor protection relays via an HMi and Modbus serial



Application

The purpose of this application example is to demonstrate how to use the HMi electronic operator interface family to control and monitor up to 16 Motor Insight® motor protection relays via a Modbus® serial network. For the purpose of this application example, the 4-inch HMi will be used (HMI04BU). Later in this document is an explanation of how to use the HMi program referred to in this document with any of the HMi family of display units. The name of the HMi program is: HMI_16MI.dop and is available on www.eaton.com/motorinsight.

The HMi program provides the following interface for up to 16 Motor Insight devices, so the operator does not need to open the cabinet to perform these functions. In other words, this HMi application provides a safe means for:

- Control
- Configuration
- Monitoring status and fault information

Note: If a Modbus master controller is being used to control the Motor Insight overload protection relays, the HMi program cannot be used. Only one master can be used to control devices on a Modbus serial network.

Overview

The control screen of the HMI program allows the operator to reset the Motor Insight motor protection relay's fault relay to allow the contactor to be energized manually with control pushbuttons or automatically with some type of controller. The normally closed fault contact on the Motor Insight is permissive, allowing control of the contactor from a device like those referenced above. The control contact from a pushbutton or controller must be placed in series with the device's fault contact. The fault contact can then open to protect the motor, but at the same time not be used as the actual control for operating the motor. Other safety interlocks should be added as needed to the application. E-stop contacts or auxiliary contacts from other contactors for sequential start applications are some examples.

The HMI program contains 12 pages for configuration of each Motor Insight in the system. This is an easy, straightforward way to commission the units and provides a safe way to modify configuration parameters during system operation.

The HMI program provides the means to monitor status and fault information. Nearly every parameter can be monitored in each Motor Insight, including each phase current, average of the three phase currents, the voltages between each phase, as well as the average of the three voltages, thermal capacity, run hours, unit ID, firmware and hardware versions, current and voltage unbalance, ground fault currents, and much more. The HMI program also provides the current fault code, a bit for all possible faults that flash when active, and a fault history, providing the last 10 faults. By having access to configuration parameters, it also allows the operator to correct a problem and clear the fault.

Table 1. Part Numbers Used for this Application Example

Description	Part Number
2–9A; 200–240 Vac (50/60 Hz) Motor Insight	C441BA ①
Modbus interface module for the Motor Insight	C441M ①
Freedom contactor	CN15DN3 ①
4-inch blue screen electronic operator interface	HMI04BU ①
24 Vdc power supply	ELC-PS01 ①

① Shielded cable for RS-485 Modbus connections between Motor Insight and the ELC controller.

Connecting the HMI to the Motor Insight Modbus interface module

The HMI connects RS-485 Modbus to the Motor Insight via the C441M Modbus serial interface for the Motor Insight. The connections must be made with shielded cable and one end of the shield must be connected to protective ground. Additional C441M Modbus interface modules connect by way of a daisy-chain arrangement, where all RS-485 + terminals are connected together as are all RS-485 – terminals.

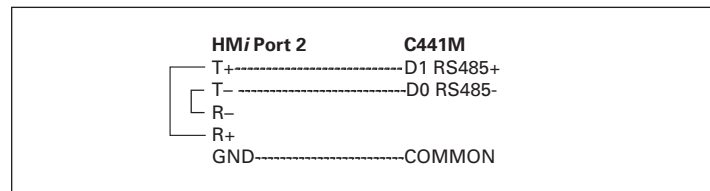


Figure 1. Connection Diagram

Note: Per the connection diagram above, T+ and R+ must be jumpered together as well as T- and R- for Port 2 on the HMI.

Configuring the Motor Insight for Modbus communications

Refer to the Motor Insight module's user manual, publication MN04209001E, for information on configuring your Motor Insight for the motor it will be protecting and other features. For this example, the HMI's Modbus port is configured for the following interface parameters:

19.2K baud, 8 bits/byte, 1 stop bit, even parity, RTU mode

The Motor Insight Modbus module must be configured with the exact same interface parameters, except the Modbus address. The HMI is node 0 and the Motor Insight devices must be nodes 1–16 on Modbus. The master on Modbus must support RTU mode. The Motor Insight does not support ASCII mode.

The Modbus interface parameters for the Motor Insight are located under the operation parameters on the unit. The Modbus Address is called the Device Address. The baud rate is located under Advanced Configuration, parameter P.00. Eight bits/byte, even parity, and 1 stop bit are the defaults and do not need to be changed for this example. If these three parameters need to be modified, they may be modified via P.01 on the keypad or via a Modbus command. Since the Motor Insight only supports RTU mode, only 8 bits/byte is allowed. The parity and number of stop bits may be modified with a Modbus write command (or P.01) to Modbus Register 442 as follows:

- Value of 0: even parity, 1 stop bit (default)
- Value of 1: odd parity, 1 stop bit
- Value of 2: no parity, 2 stop bits

Main screen

The Main screen of the HMI program is shown in **Figure 2**. It consists of a button for each possible Motor Insight overload protection relay, up to a maximum of 16. The Motor number represents the Modbus serial address associated with each Motor Insight Modbus serial interface. The HMI communicates with each Motor Insight using the Motor Insight device's default Modbus parameters as follows:

19.2K baud, 8 bits per byte, 1 stop bit, even parity, RTU mode

The only communication parameter that must be changed for each Motor Insight is the Modbus node address. The "Motor 1" button will access the control, configuration, and status pages for the Motor Insight with Modbus serial address 1. The "Motor 2" button will access the control, configuration, and status pages for the Motor Insight with Modbus serial address 2 and so on. To change the Modbus serial node address for a Motor Insight, press the Mode button until the LED next to Operation is lit. Then use the down arrow button to scroll down the Operation parameters until the LED next to Device Address is lit (second parameter from the bottom). Press the Edit/Save button and the present address will begin flashing. Press the up/down arrow keys to obtain the desired address then press the Edit/Save button again to set the address. The Motor Insight is now at the selected address.

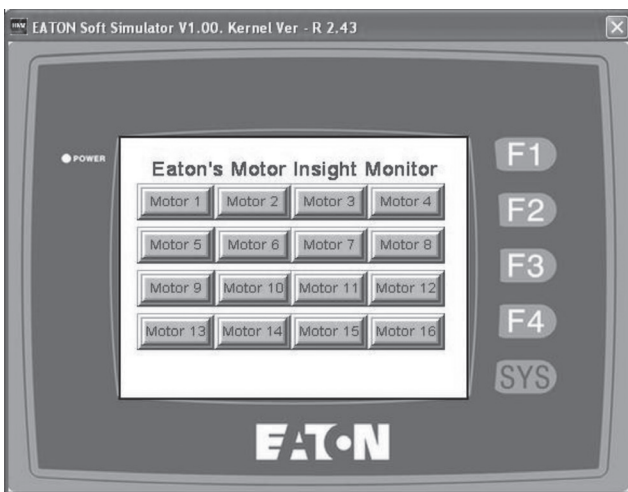


Figure 2. Main Screen

Note: If there are less than 16 Motor Insight devices connected to the HMI and a Motor button is pressed for a node that does not exist, a communication error will flash on the screen. Press the Main Page button at the bottom left of the Main Motor Page screen (which will appear behind the Error indication) until the Main Page is again displayed. The error will self-clear.

Main Motor screen

The Main Motor screen for Motor 1 is shown in **Figure 3**. It is the screen that will appear when any of the Motor buttons are pressed on the Main screen. This screen displays all the rms currents and voltages. It also provides access to Status Page 1, the Control Page, Setup Page 1, and the Fault Queue. There is also a button for getting back to the Main screen.

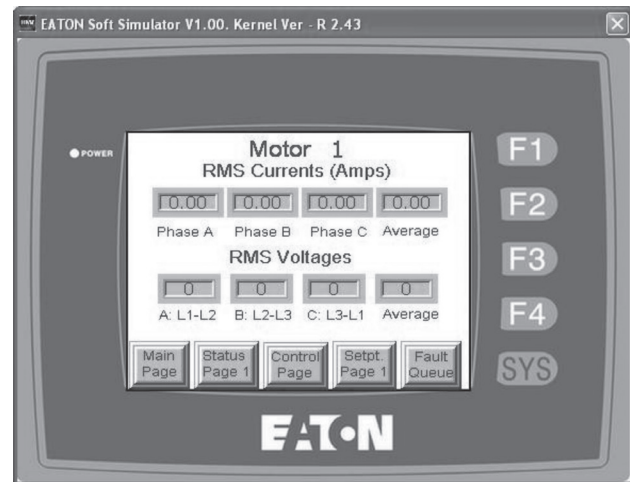


Figure 3. Main Motor Screen

Status Page 1

Status Page 1 includes fault indicators for the following faults:

- Ground fault
- Overvoltage
- Undervoltage
- Voltage unbalance
- Overload trip
- Overcurrent
- Undercurrent
- Phase reversal

This page also displays the FLA Setpoint, Percent Thermal Capacity, Run Hours, and the Last Fault code. Access to the following HMI pages is also provided: Main Motor Page, Control Page, Setpoint Page 1, and Status Pages 2 and 3.

Status Page 2

Status Page 2 includes additional fault indicators for the following faults:

- Low power (kW)
- High power (kW)
- Current unbalance
- Current single-phase trip

This page also displays the Time to Restart following a Supply Fault, Motor Fault, or Load Fault, measured in seconds. Access to the following pages is also provided: Main Motor Page, Control Page, Setpoint Page 1, and Status Pages 1 and 3.

Status Page 3

Status Page 3 includes the following status information:

- Unit ID
- OL firmware version
- UI firmware version
- Motor power (kW)
- Voltage unbalance %
- Current unbalance %
- Power factor
- Ground fault current (amps)

This page allows access to Status Pages 1 and 2. Status Page 1 is shown in **Figure 4**.

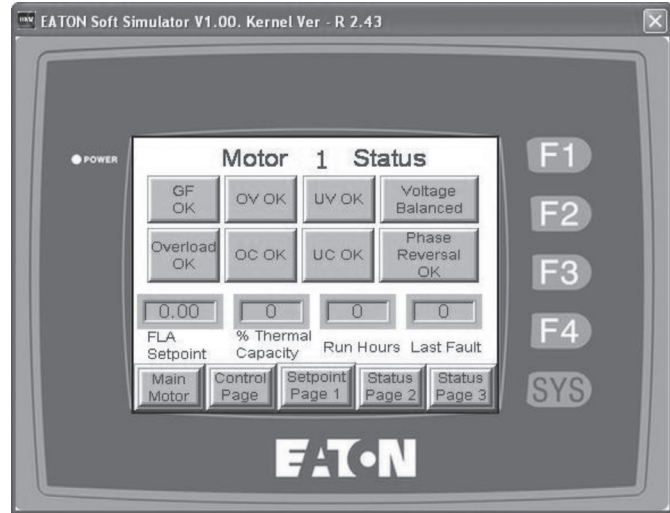


Figure 4. Status Page 1

Control Page

The main purpose of the Control Page is:

- Clear run hours
- Clear last fault
- Reset the fault relay
- De-energize the fault relay

In addition, this page includes configuration parameters. Phase Order Trip can be Enabled or Disabled and Phase Rotation and Voltage Trip Modes can be selected. A complete description of all configuration parameters can be found in the Motor Insight user manual, publication MN04209001E. Access to the Main Page, the Main Motor Page, Status Page 1, and Setpoint Page 1 is also provided. The Control Page is shown in **Figure 5** below.

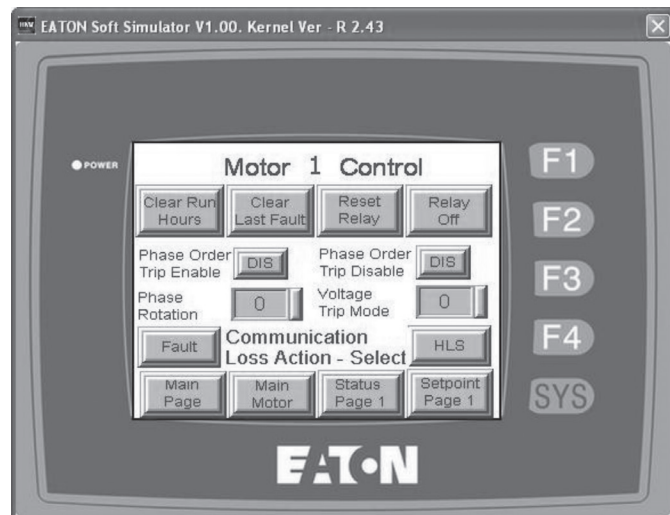


Figure 5. Control Page

Fault Queue Page

The Fault Queue Page can only be accessed from the Main Motor Page. This page displays all 10 fault queues from the Motor Insight, which are the last 10 faults. A description for each fault code can be found on pages 5–8 of the Motor Insight user manual. This page also includes a button to clear all 10 fault queues and a button to return to the Main Motor Page. The Fault Queue Page is shown in **Figure 6** below.

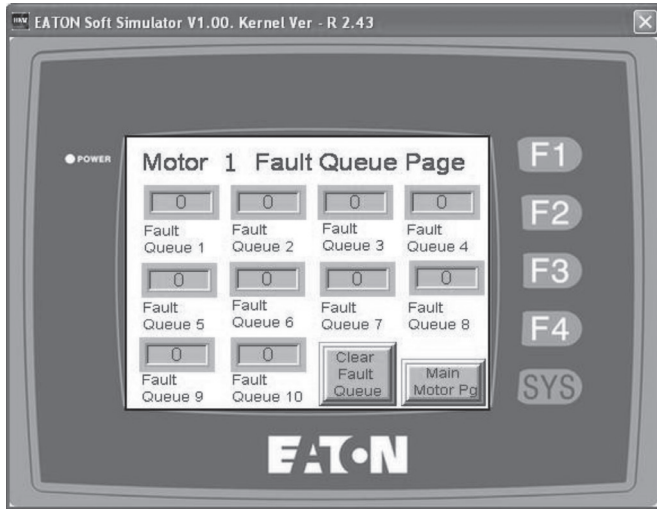


Figure 6. Fault Queue Page

Setpoint Pages 1–12

These 12 pages provide a way to configure the Motor Insight parameters. This can also be accomplished from the UI on each Motor Insight or a remotely connected UI. The HMI program, however, allows configuration for up to 16 Motor Insights from the same HMI. All configuration parameters described in Chapter 5 of the Motor Insight user manual are contained in these 12 Setpoint Pages. Setpoint Page 1 can be accessed from the Main Motor Page, the Control Page and Status Pages 1 and 2. Each subsequent Setpoint Page must be accessed from the Previous Setpoint Page. As an example of a Setpoint Page, Setpoint Page 1 is shown in **Figure 7**.

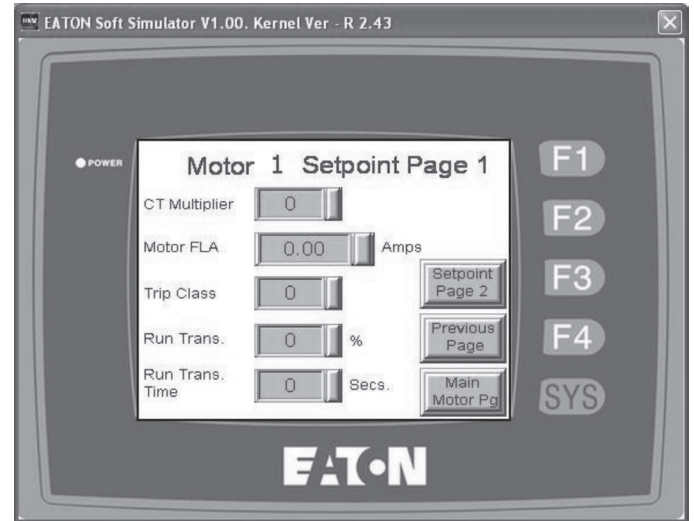


Figure 7. Setpoint Page 1

Using data entry elements

Data entry elements display the current value of a parameter and include a vertical bar on their right side, per **Figure 7**. When this bar is touched, a Data Entry screen appears, allowing the operator to enter a new value for that parameter. There are three choices on the Data Entry screen, once data is entered:

- CLR—Clears the entire entry
- DEL—Clears the last digit of the entry
- Enter—Sends the value entered to the Motor Insight

Once a value has been entered, the HMI will then read that value back from the Motor Insight and display it. That's why a very short delay may be seen between pressing Enter and seeing the value updated. Also, if out-of-range data is entered, an error message will appear and the data will not be accepted by the Motor Insight. Acknowledge it and try again.

Motor Insight— communication loss behavior

By default, when a communication loss occurs, the Motor Insight will hold last state and not indicate a fault. The Modbus master's messages will time out, indicating that communications is lost to the Motor Insight, but the Motor Insight will continue to operate. The HMI program allows the selection of the two possible Communication Loss Actions provided by the Motor Insight:

1. Hold Last State on a Comm Loss (Default)
2. Fault on a Comm Loss

The Control Page in the HMI program contains two buttons labeled Fault and HLS. In between these two buttons are the words: "Communication Loss Action—Select." If the Fault button is pressed, the Motor Insight will de-energize the fault relay, which will in turn de-energize the contactor and turn the motor off, should a loss of communications occur. If the HLS button is pressed, the Motor Insight will continue to operate in its last state should a communication loss occur. This selection can be changed at any time and as often as needed.

Using the HMI program for the HMI04BU with the other HMI displays in the HMI family

The development software for the HMI line of display products is called: HMI Soft. This software is necessary to make modifications to the attached HMI program (HMI_16MI_4BU.dop) and to use the program on other HMI devices. The procedure for changing the program from a 4-inch HMI to any of the other size HMI displays is as follows:

1. Start HMI Soft.
2. Open the program: HMI_16MI_4BU.dop.
3. Select Options, then select Configuration from the Options drop-down menu.
4. The Configuration screen opens to the Standard tab.
5. Under the HMI selection, HMI04BU 8 Blue will be displayed.
6. Click the arrow for the HMI selection to display all possible HMI units in a drop-down menu.
7. Select the HMI by its part number from the list.
8. Click OK and the software will automatically resize the entire program to fit the newly selected HMI display.
9. Under the Tools drop-down menu, select Compile—the program is now ready to download to the HMI display that was selected.
10. The attached HMI program was developed for the 4-inch blue screen HMI. If a color HMI is selected, HMI Soft can also be used to add color to the various screens.

Supporting documentation

Manuals

- HMI user manual, MN048002014E
- Motor Insight user manual, MN04209001E

Program files

- HMI program, HMI_16MI_4BU.dop

Software development tool

- HMI Soft

Additional help

In the event additional help is needed, please contact the Technical Resource Center at 1-877-ETN-CARE (386-2273).

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