E2/E2E and NVR Board Setup

Technical Bulletin

E2 and NVR Wiring Connections

Connect all the NVR communication cable shields together and then connect the shields to Earth/Chassis ground through a 125mA Fast Acting Fuse in series with a 100 ohm resistor.

DO NOT connect the NVR network shields to E2 but instead, fuse to a common ground shared with E2.

The reason for connecting the shields to Earth/Chassis ground is that the NVR circuit boards may not have an Earth/Chassis ground connection. When connecting to an E2, an Earth Ground is introduced to the Comm Shield wires. If an NVR board has one side of its power transformer shorted to Earth/Chassis ground, the board could operate properly for years, but when connected to an E2, multiple boards could short out and become damaged as a result.

The fuse amp and reaction time may need adjusting based on the results of the beta test.

When replacing an NVR master controller with an E2, the power supply is needed for the CIM modules.

The NVR master controller currently supplies power to some or all of the CIM modules.

To power 30 CIMs, a 30 to 35 VDC power supply that can source 4 Amps or more is needed.

Note: Emerson does not stock any temperature sensors or pressure transducers that are compatible with NVR boards. Emerson input boards cannot read NVR temperature sensors. For all customer installations, the customer's technician can purchase sensors from NVR. NVR should provide them at the customer's request.

- The Default Offline Delay for NVR boards should be two minutes.
- 15-second update rate for CIM boards.
- 10-second update rate for all other boards.

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Rack Input Module (RIM)

4 Boards and Applications per each E2E

RIM Input Types and Ranges

- Digital Inputs 1 to 14 - ON/OFF.
- C.T. Inputs 1 to 8 – Range: 0.0 to 68.48 Amps; No OPEN or SHORT Alarms.
  (NVR PN 733080000 Current-Sensing Transformer Ratio 100:5).
- Hi Temp Inputs 1 to 8 – Range: 2.13 to 386.1 DegF; OPEN < 15 DegF: SHORT > 375 DegF
  (NVR PN 733001000 will not read Emerson sensor).
- Low Temp Inputs 1 to 4 – Range: -460.4 to 518.3 DegF; OPEN < -40 DegF: SHORT > 375 DegF (NVR PN
  733000000 will not read Emerson sensor).
- Suction Press 1 to 3 – Range: -25.0 to 100.0 PISG; OPEN < -15 PSIG: SHORT No Alarm
  (NVR PN 733090000 Pressure Sensor 0 to100 psig will not read Emerson sensor).
- Valid address: 24 to 27. Address Jumper Settings are printed on the module's front plate.

NVR-RIM Application Setup

- **General** tab: Set the **Board Address** 24 to 27 and chose the COM Port for example, NVR-1.
- **Digital** tab: Assign the pointer's connections from DIG INPUT 1 to 14 to appropriate applications.
  For example, Standard Circuit or Suction Group.
- **CT Inputs** tab: Assign the pointers connections from CT1 to 8 to appropriate applications or for compressor
  proofing use Cut-In/Cut-Out logic configured under **CT Prf Cfg** tab and outputs under **CT Prf Outs** tab.
- **CT Prf Cfg** tab: Configure the Cut-In/Cut-Out Amps for each of the 8 CT inputs.
- **CT Prf Outs** tab: Assign the pointer's connections from CT PROOF1 to 8 to appropriate applications or for
  compressor proofing. For example, Suction Group.
- **Temperature** tab: Assign the pointer's connections to appropriate applications. HI TEMP1 to 8 are typically
  used for Compressor Discharge line temperature monitoring. LOW TEMP1 to 4 are typically used for Suction
  line temperature monitoring.
- **Pressure** tab: Assign the pointer's connections from SUCT PRES1 to 4 to appropriate applications.
  For example, Suction Group Suction Pressure.

Compressor Output Module (COM)

4 Boards and Applications per each E2E

- 10 Relays- Relays 1 to 5 N-CLOSED contacts only; Relays 6 to 10 N-OPEN/N-CLOSED.
- LED ON for Relay ON.
- 10 Override switches (1 per Relay) Auto: ON:OFF.
- Valid address: 16 to19. Address Jumper Settings are printed on the module's front plate.

NVR-COM Application Setup

- **General** tab: Set the Board Address 16 to 19 and choose the COM Port for example, NVR-1.
- **Setup** tab: Each relay can be given a name and the contacts must be configured and N-CLOSED or N-OPEN to match the physical wiring of the COM board.
- **Outputs** tab: Assign the pointer connections from the relay outputs to the appropriate application. For example, Suction Control.

Note: The Status Screen "Override" status shows that a Relay is in override but not the override ON/OFF state.

Rack Output Module (ROM)

8 Boards and Applications per each E2E

- 16 N-OPEN/N-CLOSED relays.
- LED is ON for energized relay.
- Valid address: 32 to 39. Address jumper settings are printed on the module's front plate.

NVR-ROM Application Setup

- **General** tab: Set the **Board Address** 32 to 39 and chose the COM Port for example, NVR-1.
- **Setup** tab: Each Relay can be given a name and the Contacts must be configured and N-CLOSED or N-OPEN to match the physical wiring of the ROM board.
- **Outputs** tab: Assign the pointer's connections from the Relay Outputs to the appropriate application. For example, Standard Circuit.

Case Input Module (CIM)

30 Boards and Applications per each E2E

- Use a separate com port (NVR-2) from other boards because the addresses may overlap.
- 8 Temperature inputs and 1 digital OPEN/CLOSED input.
- Valid address: 0 to 63. Set dip switch positions 1 to 6, in same format as Emerson addressing (use RCB as example to get 63 addresses). CIM/2 modules have an 8-position dip switch, dip switch position 7 must be ON for 9600 baud and dip switch position 8 must be OFF for E2 communications.
- Power Requirements: CIM modules require 24 VDC power (approximately 33 VDC to cover line drop), the CIM/2 modules support 24VAC or 24VDC power. When daisy chain wiring power is connected to multiple CIM or CIM/s modules, polarity must be maintained to prevent damage to modules.

CIM Input Types and Ranges

- Digital Inputs 1 - Range: OPEN/CLOSED.
- CIM Temp Inputs 1 to 8 - Range: -39.5 to 88.0 DegF; OPEN < -35 DegF: SHORT > 85 DegF (NVR PN 733000000 will not read Emerson sensor).
- +/- 9 DegF offsets for CIM temp inputs.

NVR-CIM Application Setup

- **General** tab: Set the **Board Address** 1 to 63 and choose the COM Port. For example, NVR-2.
- **Inputs** tab: Assign the pointer's connections from the CASE TEMP inputs to appropriate application. For example, Standard Circuit. The optional DUAL TEMP digital input may also be connected for circuits using a dual temp switch at the case.
- **Names** tab: Each input can be given a name.
- **Offsets** tab: Each of the 8 Case Temp inputs can be given a temperature offset of +/-9 Differential Degrees Fahrenheit.

Condenser Control Module (CCM)

4 Boards and Applications per each E2E

- 10 relays - with N-OPEN/N-CLOSED contacts.
- LED is ON for energized relay.
- 1 Override switch per board - AUTO:OVERRIDE (relays de-energized).
- Valid address: 20 - 23. Address jumper settings are printed on the module's front plate.
- Phase Loss Operation - Phase Loss State determined by E2E and sent as priority update of message.
- High Discharge Trip - If the discharge pressure exceeds a board-determined value, all relays de-energize to force N-Closed wired fans ON. If the discharge pressure drops below a board's determined value, all relays energize to force N-Closed wired fans OFF.

CCM Input Types and Ranges

- Air Temp Input 1 - Range: -460.4 to 518.3 DegF; OPEN < -40 DegF: SHORT > 375 DegF
  (NVR PN 733000000 will not read Emerson sensor).
- Discharge Press 1 - Range: -100.0 to 400.0 PISG; OPEN < -60 PSIG: SHORT No Alarm
  (NVR PN 733091000 Pressure Sensor 0 - 400 psig will not read Emerson sensor).

NVR-CCM Application Setup

- **General** tab: Set the **Board Address** 20 to 23 and choose the COM Port for example, NVR-1.
- **Setup** tab: Each relay can be given a name and the contacts must be configured and N-CLOSED or N-OPEN to match the physical wiring of the CCM board.
- **I/O** tab: Assign the pointer's connections from the Relay Outputs, Discharge Pressure, and Outside Air Temp to appropriate applications. For example, Condenser Control.
- **OVR SWs** tab: OVR STAT 1 to 10 pointer connection for Override status of individual relays. When the CCM board's single override switch is in the Override position, all 10 relays are de-energized. CCM STATE1 to 10 pointer connection for relay current control state. Note: the CCM STATE1 to 10 may be different from the command status issued by connection under the **I/O** tab for relays RO1 to RO10. If the CCM board determines that the Discharge pressure is too high, the CCM board may force all or some of the Relays ON (de-energize), if the Discharge Pressure is too low, the CCM board may force all or some of the Relays OFF (energize). This logic is not controlled by the E2.The CCM board controls this logic and may vary with CCM board version.

Analog Output Module (AOM)

8 Boards/Applications per E2E

- 4 Analog Voltage Outputs: 0 to 10Vdc or 10 to 0Vdc.
  Note: 10 to 0Vdc outputs have an offset added of approximately 0.2V to ensure a 0% actuator at
  10 Volts is fully closed.
- Valid address: 56-63

8 Input Module (8IM)

8 boards/applications per E2E - use same com port as the CIM's

- Use a same com port (NVR-2) as CIMs and verify the addresses do not overlap.
- 8 inputs: each input can be Analog 1 to 5V, Analog 4 to 20mA, or Digital OPEN/CLOSED.
- Valid address: 0 to 63. Set dip switch positions 1 to 6, in same format as Emerson addressing (use RCB as the example to get 63 addresses). 8IM modules have an 8-position dip switch, dip switch position 7 must be ON for 9600 baud, and dip switch position 8 must be OFF for E2 communications.
- Power Requirements: 8IM modules require 24 VDC power (approximately 33 VDC to cover line drop), and may support 24VAC or 24VDC power (verify each device before applying power). When daisy chain wiring power is connected to multiple 8IM modules, polarity must be maintained to prevent damage to modules.

E2E and NVR Board Setup

Overview

The E2 supports a licensed, third-party NVR board. The five NVR board types are:

1. NVR-CCM (Condenser Control Module)
2. NVR-CIM (Case Input Module)
3. NVR-COM (Compressor Output Module)
4. NVR-RIM (Rack Input Module)
5. NVR-ROM (Rack Output Module)
6. NVR-AOM (Analog Output Module)
7. NVR-8IM (8-Input Module)

Each E2 controller can support up to 4 NVR-CCM, 30 NVR-CIM, 4 NVR-COM, 4 NVR-RIM, 8 NVR-ROM, 8 NVR-AOM, and 8 NVR-8IM applications.

NVR board applications must be purchased with a license key to enable E2E communications. For licensing instructions, refer to the *E2 User Manual's (P/N 026-1614) License Management* section.

Pre-Install Checklist

When retrofitting an E2E in place of the previous controller, the following actions should be taken before disconnecting the I/O boards from the previous controller:

1. On the NVR RC network status screen (for each of the four board types), identify and record which board addresses are online and offline. When the system is switched to E2E, the same online/offline pattern should be seen.
2. Ensure all NVR board address settings are left unchanged. This allows the system to be switched back to control by the previous controller for troubleshooting, and to keep any existing system wiring documentation accurate.
3. Make a note of any analog sensor input values that are not reading correctly on the previous controller system. Faulty sensors or problem cases/equipment should be identified before transitioning to the E2 controller.
4. On all relay output cards equipped with override switches (NVR-COM's and NVR-CCM's), make a note of which output switches are currently in override and record the physical switch override position.

Network Wiring and Configuration

NVR boards connect to the E2 controller by using an RS485 bus, supporting remote configuration and data acquisition. You should wire NVR boards to the E2 controller, then wire NVR Network Module- to E2 -RS485 terminal and wire Network Module+ to E2 +RS485.

Note: *Do NOT connect the Network Module SHIELD to the E2 RS485 0V terminal.*

Network Connection to the E2 Controller

Note: *Connecting an NVR module to an E2 unit requires E2 version 4.07 or above. Contact Emerson for upgrade information if the controller is below version 4.07.*

- An E2 has up to three COM ports that can be assigned for NVR board communication (COM2, an RS485 port on the E2 power interface board and COM4 and COM6, which are external RS485 cards).
- COM Ports can only be used for one function. If COM2 is set up as the I/O network, you cannot connect NVR boards to COM2. If COM2 is not used for NVR boards, ensure that your E2 is equipped with an RS485 COM Card (*P/N 637-4890*) and configured in E2 General Controller Info (press [Menu], [7], [3], [1], then press [F2] twice, to go to **Serial** tab) to enable COM4.
- Connect the network cable to the three-terminal connector on the COM Port that is previously configured as NVR. The NVR board polarity markings are the same as the E2. Connect the NVR+ Data wire to the E2 RS485+ terminal and connect the NVR -Data wire to the E2 RS485- terminal.
  Note: *The shield cable should NOT be connected to the middle terminal.*
- Terminate the E2 with all three jumpers in the terminated (UP) position.

E2 Setup for NVR I/O Devices

Setting Up Network Ports

Note: *Before communicating to an NVR, the port on the E2 (that has a cable connected to the NVR boards) must be configured to use the NVR protocol.*

1. Log into the E2 controller with Level 4 access.
2. Press [Menu], [7], [3], [1] (*General Controller Info*).
3. Press [F2] twice to go to the *C3: Serial* tab.
4. Highlight the COM Port connection field that will be used for NVR I/O, and press [F4] (*LOOK UP*).
5. From the list of network types, select **NVR-1**, **NVR-2**, or **NVR-3**.
6. Press [⟲] to save changes.

Adding and Connecting NVR Modules

To enable the communications between the E2 and the NVR modules, the devices must be added and addressed in the E2 controller.

1. Log into the E2 controller with Level 4 access.
2. Press [↩], [7], [7], [2] (*Connected I/O Boards and Controllers*).
3. Press [F2] twice on the Connected I/O screen to move to the **C4: Third Party** tab. Enter the number of devices (NVR-CCM, NVR-CIM, NVR-COM, NVR-RIM, and NVR-ROM) under **Quantity**.
4. Press [Menu], [7], [7], [1] to open the **Network Summary** screen.
5. Locate the NVR device you added by pressing the down arrow key and press [F4]. If desired, you can enter a new name for each device in the **Name** field.

Troubleshooting NVR I/O Boards and the RS485 Bus Network

Problem, Possible Cause, and Action

All NVR Boards Offline

- **Incorrect Network Polarity Wired in the E2 Controller**. Make sure that the +Data wire from the NVR network is connected to the RS485+ terminal on the E2 and the -Data wire from the NVR network is connected to the RS485- terminal on E2.
- **COM Port Not Set Up**. Press [Menu], [7], [3], [1] to open **General Controller Info** screen. Verify if COM2 or COM4 are configured correctly for Network Port connection.
- **Improper Network Termination**. Verify if the E2 jumpers are in the terminated position, and if a 150-ohm resistor is connected between the plus and minus RS485 terminals at the NVR device at the end of the daisy chain.
- **Improper Network Cabling**. Check if the network cable is Belden #8641 or equivalent.

Single NVR Board is Offline

- **Loose Network Wire**. Check the wiring connections.
- **Incorrect Network Polarity wired at I/O board**. Make sure that the RS485+ from the E2 is connected to the +Data terminal and RS485- from E2 is connected to the -Data terminal.
- **Board is Set to Wrong Address**. Make sure that the address setting jumpers are correct.
- **No Power**. Check voltage on the board's power input terminals. This is typically 24VDC for the CIM boards and 24VAC for all other board types. Check the label markings of the individual boards.

Relay Output Operates in Reverse

- **Relay Contacts are Configured Wrong**. Verify if the N-CLOSED or N-OPEN configuration in the E2 matches the physical relay wiring connections.

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