

Control Link ECT Modbus Networking to E2s

The ECT Solutions Control Link family of products are designed for a wide variety of both stand-alone and networked controls solutions. Control Link devices such as the CL-RSC (refrigeration controller) and CL-CD (case display) may be networked with E2s version 2.3 and above. This technical bulletin shows the steps to follow when networking one or more Control Links with a parent E2.

Networking

Control Link modules communicate with a parent E2 controller using a MODBUS network. Each Control Link module must be equipped with a network card (P/N 618-2080), which plugs into the "Network Comm. Bus" socket. The network card has a three-terminal connector for wiring the MODBUS network cable, and a DIP switch bank with eight switches for assigning the module a unique network address.

Control Link modules must be networked together in a daisy-chain configuration (all modules networked in series from the E2, and terminated at the two end devices). No splits or "star configurations" are allowed. The network cable must be Belden #8761 or equivalent. Observe network polarity, wiring RS485+ to RS485+, 0V to 0V, and RS485- to RS485- (see Figure 1).

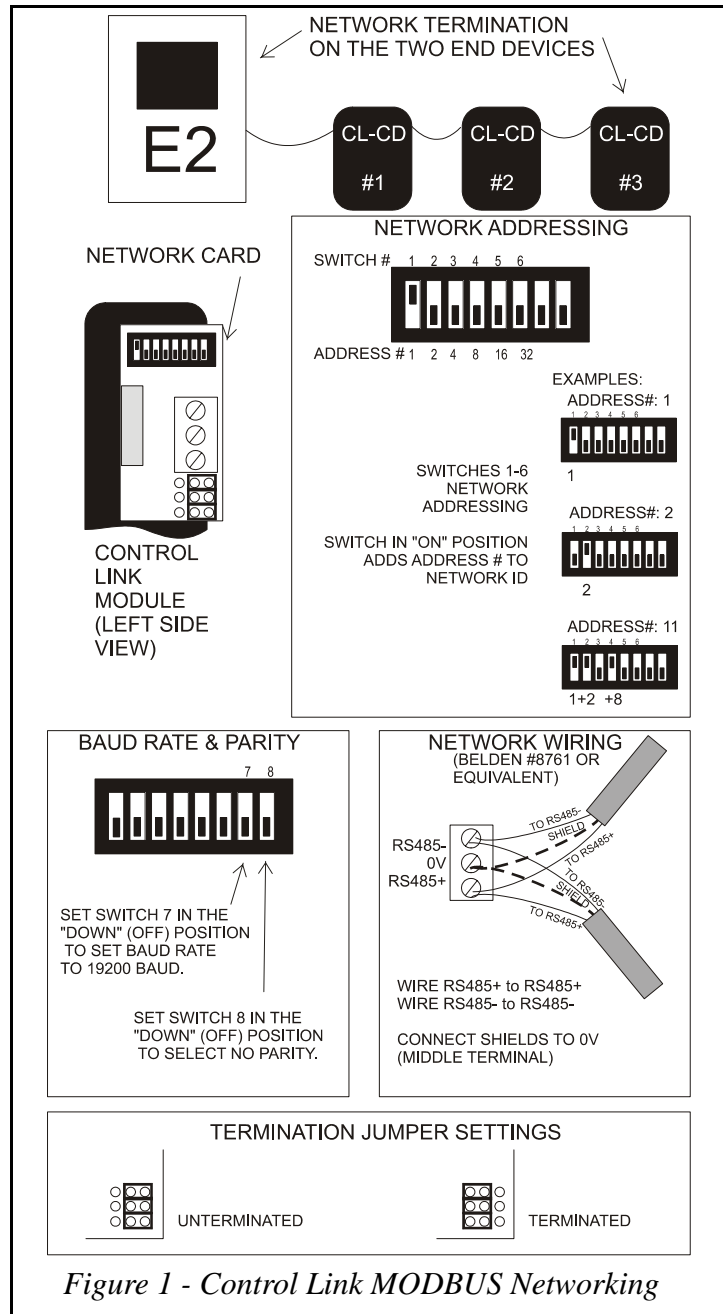


Figure 1 - Control Link MODBUS Networking

Termination

The devices at both ends of the daisy chain must be terminated using the network termination jumpers. On the Control Link network card, these are located below the network connector. To terminate a device, set all three termination jumpers to the LEFT position (i.e. toward the rear of

the module). To unterminate a device, set all three jumpers to the RIGHT position (i.e. toward the front of the module). Refer to Figure 1.

Control Link Network Addressing, Baud Rate, and Parity

Each Control Link module must have a unique network address. The network address is set by switches 1-6 of the DIP switch bank on the network card. Switches 1-6 correspond to binary digits of the network address (1, 2, 4, 8, 16, and 32 respectively). Each switch in the UP (ON) position adds the corresponding value to the network address. Control Link modules should be numbered in order starting with unit #1 (see Figure 8).

Switches 7 and 8 set baud rate and parity. Set switch 7 to DOWN (OFF) to set the baud rate at 19.2k. Set switch 8 DOWN (OFF) to specify no parity.

Network Connection to E2

Connecting a Control Link module to an E2 unit requires the E2 to be version 2.30 or above. Contact CPC for upgrade information if the controller is a version before 2.30.

An E2 has up to three COM ports that can be assigned for MODBUS communication (COM2, an RS485 port on the E2 power interface board, and COM4 and COM6, which are optional ports requiring expansion cards). COM ports can only be used for one function; in other words, if COM2 is set up as the I/O network, you cannot connect MODBUS devices to COM2. It is likely, unless the parent E2 will only be used for networking to Control Links, that COM4 or COM6 must be used for connection to Control Link devices. Ensure your E2 is equipped with an RS485 COM Card (P/N 637-4890) to enable COM4 or an E2 Expansion COM Card (P/N 637-4871) to enable COM6.

Connect the MODBUS network cable to the three-terminal connector on the COM port you wish to assign as MODBUS. Like the Control Link connections, wire RS485+ to RS485+, RS485- to RS485-, and the shield cable to the middle terminal. If the E2 will be the first device in the daisy-chain, set the port's termination jumpers to the TERMINATED position (all three jumpers UP); otherwise, set all jumpers DOWN to unterminate.

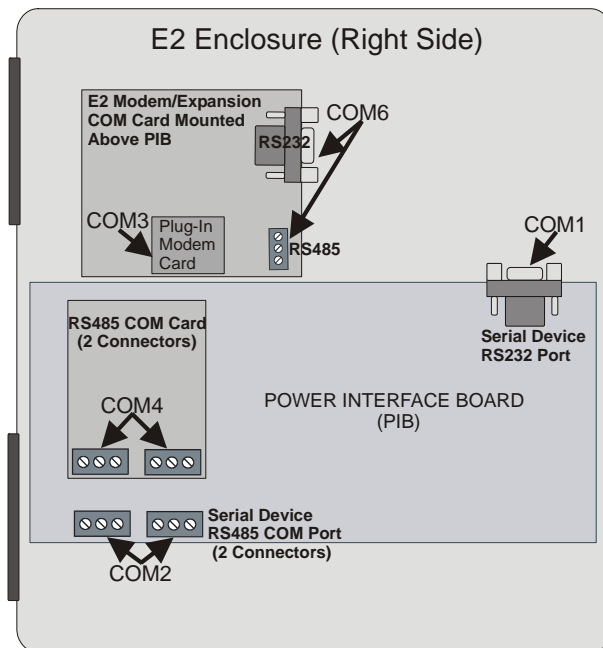








Figure 2 - Location of E2 COM Ports

E2 Setup of Control Link Devices

Set Up Network Ports

Before setting up Control Links, the port on the E2 that has the MODBUS cable connected must be set up as a MODBUS port.

1. Log in to the E2 with Level 4 access.
2. Press  followed by    - “General Controller Info.”
3. Press   to open the Serial tab of the General Controller Info setup screens.

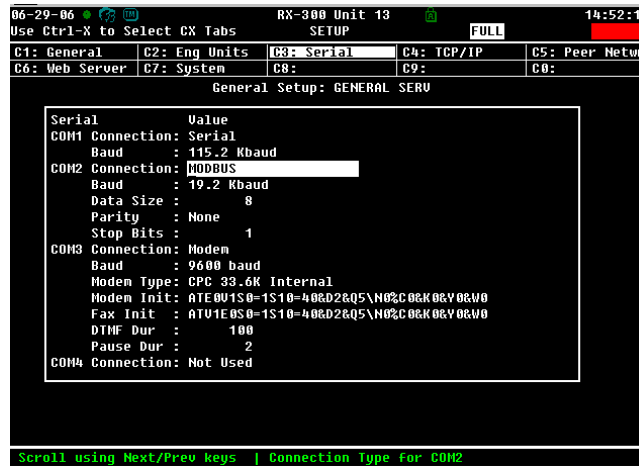




Figure 3 - Serial Communication Manager Screen

4. This screen will have a “Connection” field for all COM ports on the E2. Highlight the COM port connection field that will be used for Control Link, and press  - LOOK UP. From the list of network types, select “MODBUS.”
5. Four fields will become visible underneath the COM port connection field, which pertain to the way the device communicates:
 - **Baud** - This should always be set to 19.2k baud to match the baud rate dip switch settings of all Control Link devices.
 - **Data Size** - Leave this field at the default value (8).
 - **Parity** - Leave this field at the default value (None).
 - **Stop Bits** - Leave this field at the default value (1).
6. Press  to save changes and exit.

Add and Connect Control Links

To enable communications between E2 and the Control Link units, the devices must be added and addressed in E2.

1. Log in to the E2 with Level 4 access.

2. Press & & & - “Connected I/O Boards and Controllers.” (Figure 4)

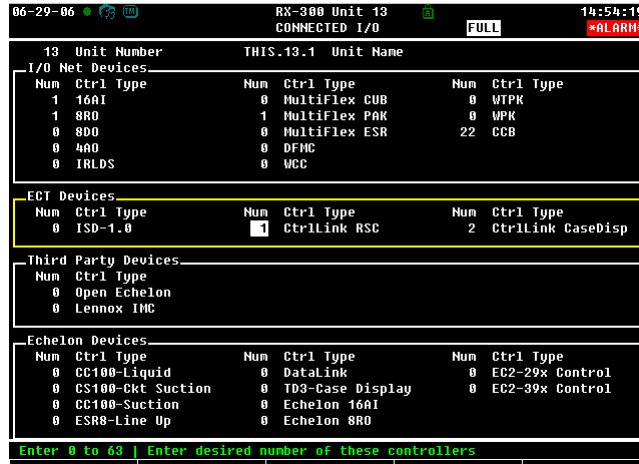


Figure 4 - Connected I/O Screen

3. In the Connected I/O screen, in a box labeled “ECT Devices,” there will be “Num” parameters for all Control Link model types. For each model type, enter the quantity of devices.
4. Press to return to the Network Setup menu, then select - “Controller Setup.”
5. Locate the CtrlLink units you added to the network list (press and to scroll through the list). The default name for a Control Link is a code string beginning with a two-letter designator of the model type (“CD” for case display, etc.).. If desired, enter a new name for each device in the Name field.

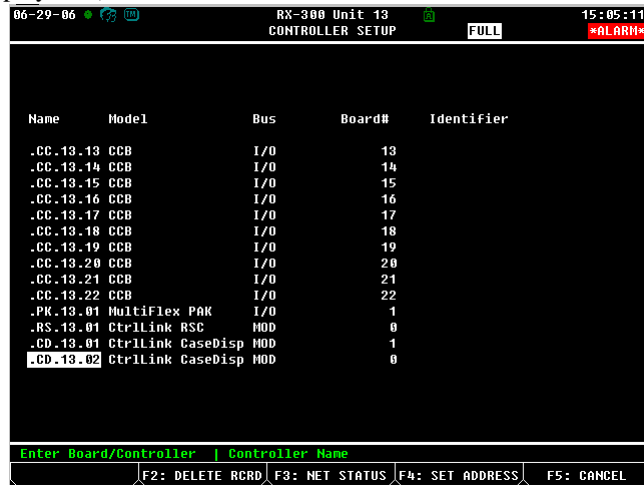


Figure 5 - Controller Setup Screen

6. By default, each CtrlLink in the network list has a board number of 0. To set the address and begin communication, press and select - “Select Address.” In the list of MODBUS devices, choose the address number corresponding to the Control Link’s dip switch setting, and press to select it. If a network ID has already been selected, its name will be shown next to the network ID in this list. If the network ID you

are trying to assign has already been used, you must set the network ID dip switch on this device to a different number that is not being used.



Figure 6 - List of MODBUS Devices

Repeat steps 5 and 6 until each Control Link device has a name and address.

When finished, press to return to the Network Setup menu, then press - “Controller Status.” Locate the Control Links you set up, and look at each device’s status in the Status field. You will see one of the following messages:

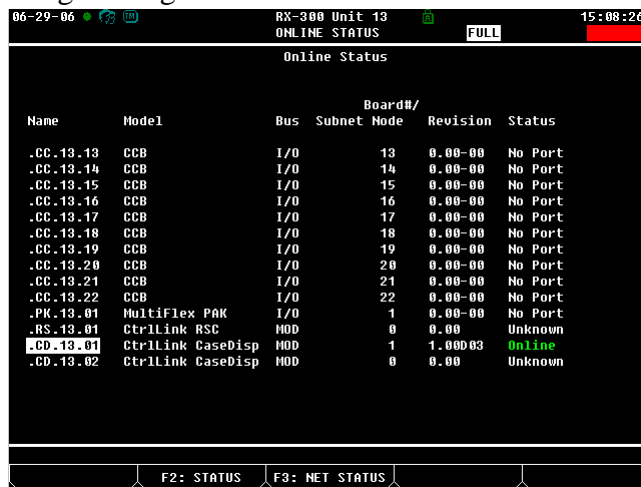


Figure 7 - Controller Online Status Screen

- **Online** - The Control Link is communicating normally.
- **Unknown** - The Control Link is not communicating. Verify the Control Link is powered up, wired correctly, and has the proper network address, baud rate, and parity (see “Troubleshooting” on page 11).
- **No Port** - No port is set up in the E2 Serial Configuration Manager to be a MODBUS port. Follow the instructions in “Set Up Network Ports,” page 3.
- **Out of Synch** - Online, but the setpoints in the Control Link device are different from the setpoints stored in the E2. Refer to “Control Link Configuration Synchronization,” page 6, for more information.

- **Wrong FW Rev** - This message is likely caused by the Control Link having a firmware version older than the minimum revision required by E2 for communication. Replace the Control Link with a new controller that has the latest version of firmware on it.





Control Link Configuration and Configuration Synchronization

When a Control Link is networked with an E2, the configuration (setpoints) of the Control Link device are stored in two places: in the Control Link's own memory, and in the E2. Configuration may be changed either from the keypad on the Control Link or through the E2 front-panel interface, but in order for changes made in the device to be saved in the E2 configuration (or vice-versa), configurations must be synchronized so that the setpoints will be the same in both the Control Link device and in the E2.

Control Link may be programmed to keep configurations synchronized in three different ways. You will need to choose the one that best fits the way controls are serviced by store personnel or contractors. However, there are two actions that result in configuration synchronization regardless of the strategy used:

1. When a Control Link is commissioned (assigned an address), the configuration is grabbed from the Control Link device and saved into the E2's application information for that Control Link. This ensures that if a Control Link has already been installed by an equipment manufacturer and set up with the proper configuration set points, the E2 will use this configuration so the field installation technician will not have to re-enter it.
2. If a change to a Control Link's configuration is made through the E2, changes will always be sent down to the Control Link and saved in the device's memory.

How to Select a Strategy

1. Log in with Level 4 access, and press   - Configured Applications.
2. Highlight the model name of the Control Link device you want to synchronize, and press .
3. In the summary screen that appears, highlight the name of the Control Link device you want to synchronize, and press  - SETUP.
4. Locate the field named "CfgSyn Action" in the Control Link's setup screens (usually in a tab titled "Device"). Set this field value to the strategy you wish to use:
 - **Manual Control** - Configurations are kept synchronized by manual control (see Strategy 1, below).
 - **Send Device Cfg to E2** - When an out-of-synch condition occurs, the E2 synchronizes by writing the setpoints of the Control Link device to E2 (see Strategy 2, below).
 - **Send E2 Cfg to Device** - When an out-of-synch condition occurs, the E2 synchronizes by writing the setpoints of the E2 to the Control Link device (see Strategy 3, below).

Strategy 1: Manual Configuration Synchronization

This is the default synchronization strategy for all Control Link devices. This strategy forces the user to log into E2 and manually synchronize configuration anytime a change to a Control Link's configuration is made from the device. This means every time a technician changes a setpoint from the Control Link device, the technician must log into the E2 and manually upload the setpoint changes from the device to the E2.

Benefits

- Technicians who are not authorized to make changes to setpoints cannot make permanent changes to the E2 configuration through the Control Link device. If a setpoint change is made to a Control Link by someone without access to an E2, an alarm will be generated notifying response personnel of an out-of-synch condition. That person can then resolve the out-of-synch condition by either accepting the changes and uploading them to the E2, or overwriting them with the setpoints stored in the E2.
- The Control Link keypad interface can be used to make temporary changes while servicing the device being controlled. When finished, the technician has the choice of rewriting the old setpoints from E2 or accepting the changes made from the Control Link and saving them to E2.

Drawbacks

- When UltraSite32 is used to restore configuration to an E2, any out-of-synch conditions must be resolved manually. Depending on the age of the setpoints and the number of devices, this may be a time-consuming task.
- Manual synchronization adds an extra step technicians will have to remember to perform when on a service call. If a technician is not aware that all changes made in a Control Link must be manually synchronized (or if the technician forgets to synchronize), he or she might leave one or more units in an out-of-synch condition.
- When replacing Control Link hardware, technicians must remember to do a manual synchronization from E2 to write the proper setpoints to the Control Link.

Recommendations

Because any changes to the Control Link made through the E2 are automatically synchronized with the Control Link, Strategy 1 is recommended for situations where you want all technicians who service the site to use the E2 for all setpoint changes, and where you can be reasonably sure the technicians who service your site are trained in how manual configuration synchronization works in E2/Control Link networks. With this strategy, the technicians can still make temporary changes to the device settings while servicing it without directly altering the settings in the E2.

Strategy 2: Send From Control Link

In this strategy, any changes saved to the configuration of a Control Link device are automatically sent up to the parent E2. Since changes made through the E2 are also sent down to the Control Link regardless of the strategy being used, Strategy 2 creates a “two-way street” between the Control Link and the E2, where changes in one are automatically sent to the other.

Benefits

- No need for manual synchronization when changes are made from the Control Link device.
- Technicians trained to work with Control Link but not trained to work with E2 may service devices without having to use the E2.

Drawbacks

- When Control Link hardware is replaced with new hardware, if the replacement hardware is also configured to send up to E2, the E2's setpoints will be overwritten by whatever is in the replacement hardware. This means the replacement hardware may have to be reprogrammed by hand from the Control Link keypad.
- An UltraSite32 setpoint restore to the parent E2 will not restore Control Link setpoints. Regardless of the setpoints written to the Control Link applications in the E2, the Control Link devices will resolve any out-of-synch conditions by writing their current setpoints to the E2.
- Depending on the model of Control Link, some settings in the device will only be programmable through the E2. Therefore, technicians not familiar with E2 may not be able to fully change or configure settings when necessary.
- The strategy allows anyone with the passwords to Control Link devices to make setpoint changes to the E2 without any record of who made the change or why. This strategy poses a security threat to the controller that might result in equipment failure or product loss unless accessibility to the Control Link devices is guarded by physical location and/or passwords.

Recommendations

Strategy 2 is best suited for organizations where the devices being controlled are serviced by personnel untrained in using the E2. Technicians who service Control Links where this strategy is being used must know to do all setpoint changes and configuration through the Control Link and be prepared to manually reprogram replacement Control Link hardware. Service techs who use the E2 must be aware that setpoint restores will not restore setpoints to Control Link devices when this strategy is used.

Strategy 3: Send From E2

In this strategy, the only way Control Link configurations may be permanently changed is through the E2. Though setpoint values may be viewed using the Control Link keypad, any changes made to the Control Link from the keypad are immediately overwritten by the E2. The exception in this case is when a Control Link is first added to the E2 network, in which case the E2 always pulls the setpoints from the Control Link device.

Benefits

- Forces service technicians to perform all setpoint changes through E2, where user access and configuration changes may be logged.
- Setpoint restores to E2 from UltraSite32 will write Control Link setpoints to the devices automatically with no need for manual synchronization.
- Control Link keypads are fully secure — unauthorized personnel can not make permanent or temporary changes to configuration.

Drawbacks

- Because out-of-synch conditions are immediately handled by an E2 over-wirte of the Control Link set-points, the Control Link keypad cannot be used to make any kind of changes, permanent or temporary. This might be inconvenient for technicians who need to troubleshoot a device on the store floor when the parent E2 is a long distance away.
- Technicians who do not know changes made from the Control Link keypad are not saved may get confused by the Control Link's behavior if attempting to change setpoints in the Control Link.

Recommendations





Strategy 3 is recommended for organizations who want all technicians to use E2 as the only means of interacting with Control Link devices.

Out of Synch Conditions and Strategy Summary







Table ??? shows all of the possible ways setpoints between the E2 and Control Link devices can go out-of-synch, and how each strategy behaves when an out-of-synch condition occurs.

Out-Of-Synch Condi-tion Cause	Strategy 1 (Manual Synch) Response	Strategy 2 (Send from Control Link) Response	Strategy 3 (Send from E2) Response
User changes setpoints on Control Link from E2	Write changes to Control Link	Write changes to Control Link	Write changes to Control Link
Control Link is commis-sioned for the first time	Write setpoints to E2 from Control Link	Write setpoints to E2 from Control Link	Write setpoints to E2 from Control Link
User changes setpoints on Control Link from the Control Link keypad	None (user must manu-ally synchronize)	Write changes to E2	E2 overwrites changes with its own stored set-points immediately upon saving.
Control Link main mod-ule is replaced	None (user must manu-ally synchronize)	Configuration in E2 is overwritten by the set-points in the new Control Link main module.	E2 writes setpoints to Control Link.
E2 setpoints are restored from UltraSite32	None (user must manu-ally synchronize)	Configuration in E2 is overwritten by Control Link	E2 overwrites Control Link setpoints with the setpoints from the restore
Control Link MODBUS address is changed	None (user must manu-ally synchronize). Or, if the new MODBUS address is not commis-sioned in the E2, com-missioning will write setpoints from the Con-trol Link to the E2.	Configuration in E2 is overwritten by Control Link. Or, if the new MODBUS address is not commissioned in the E2, commissioning will write setpoints from the Con-trol Link to the E2.	E2 overwrites Control Link setpoints with the setpoints for the new address. Or, if the new MODBUS address is not commissioned in the E2, commissioning will write setpoints from the Con-trol Link to the E2.

Checking Synchronization Status and Manual Synchronization

It is recommended any time Control Link devices are replaced or worked on that you check to make sure the configurations are synchronized. You may check for Control Links that are out of synch by viewing the Online Status screen. Press     from the E2 front panel and locate the Control Link devices in the device list. The State of any Control Link device will read “Out of Synch” if the configurations are out of synch.

An out-of-synch condition can be resolved manually from the E2 front panel.

1. Log in with Level 4 access, and press   - Configured Applications.
2. Highlight the model name of the Control Link device you want to synchronize, and press .
3. In the summary screen that appears, highlight the name of the Control Link device you want to synchronize, and press .
4. From the Control Link device’s status screen, press  to access the Actions Menu, then press  - Application Commands.
5. There are two options in the Application Commands menu that pertain to Control Link synchronization. Select the action you wish to take:
 - **Send Device Cfg to E2** - Select this option if you want to copy the configuration in the Control Link to the E2.
 - **Send E2 Cfg to Device** - Select this option if you want to copy the configuration in the E2 to the Control Link.
6. After selecting an action, the configurations will synchronize. Return to the Online Status screen and verify the status of the Control Link device now says “Online.”

Alarm Handling with Control Link Devices and E2s

Alarms that pertain to devices controlled by Control Links can come from either of two sources: the Control Link itself, or the E2 application associated with the Control Link. For example, the Control Link CD (case display) reads case temperature sensors and feeds their values back to E2 applications that associate with Standard Circuit applications. The E2 is responsible for generating high temperature and low temperature alarms based on comparing the case temperatures to the Standard Circuit’s alarm setpoints. The Control Link is only programmed to alarm when temperature sensors fail to provide valid readings.

Alarms Generated by E2

If an alarm pertaining to a Control Link device is generated by an E2, all handling of that alarm (including acknowledging, resetting, or clearing the alarm) must be handled through the E2 front panel. The Control Link display will not show an alarm message, and the Control Link’s Alarm Silence button may not be used to affect the active status of the alarm.

Some models of the Control Link are programmed to turn ON the designated Alarm LED on the Control Link front panel when the E2 generates an alarm pertaining to the device. For example, if a Control Link CD is associated with a Standard Circuit application and the Standard Circuit generates a high temp alarm based on the Control Link’s temperature reading, the Control Link CD

will turn on its Status LED as a visual indicator to floor personnel that an alarm is active. This LED will likewise turn off when the alarm is reset, cleared, or returned to normal. Refer to the installation and operation instructions for the specific model types for more information on how the LEDs work in correlation to the E2 alarm status.

Alarms Generated by Control Link

Each Control Link unit is programmed to detect and display a fixed set of alarm conditions specific to the type of device it controls. When a Control Link alarm occurs, the default display on the Control Link shows a four-character message. Typically, the label on the front of each Control Link module will list all alarm messages and their meanings for easy reference. Additional information about alarms may also be available in the installation and operation instructions for the specific Control Link model.

If multiple Control Link alarms are active at the same time, the Control Link display only shows the alarm that occurred first. The Control Link does not allow viewing multiple alarms from the keypad and display, nor does it log the time and date of the alarm's occurrence. If an E2 is connected to the Control Link's network, the Control Link will pass the alarm to E2, where it will be logged along with the time and date and reported the same way as other E2 alarms.



Handling Alarms Generated by Control Link







When one or more alarms are active in the Control Link, pressing the ALARM SILENCE button on the Control Link keypad causes all active alarms to be cleared from the Control Link front display. If the alarms have been reported to a parent E2, pressing the ALARM SILENCE button will cause all the alarms in the E2 to return to normal, which has the same function as resetting the alarms from the E2, except the State of the alarm will be "N-ALM," "N-NTC," or "N-FL," which normally indicates the alarms returned to normal by themselves and were not forced to reset.

If alarms are active in the Control Link and the alarms are reset or cleared from the E2, they will be cleared on the Control Link display just as if the ALARM SILENCE button were pressed on the keypad. If reset, the State of the alarm in the E2 alarm log will properly show "R-ALM," "R-NTC," or "R-FL," properly indicating the reset was forced by a user.



Troubleshooting Control Links and the ECT MODBUS Network

Problem: Control Link Offline

1. **Check wiring** - Verify the Control Link is properly connected to the MODBUS cable. Verify the network polarity is correct (+ to +, - to -, 0V to 0V) and there are no loose wires. If none of the Control Links are online, check wiring connections on the E2. Check the cable jackets to make sure all network cable is Belden #8761 or equivalent.
2. **Check Control Link network card** - Make sure the Control Link has a network card installed and the card is plugged into the "Network Comm. Bus" slot on the Control Link module.
3. **Verify MODBUS Port Setup** - Press  +  on the E2 front panel. Verify COM2, COM4, or COM6 is set up as a MODBUS port. If so, verify that the MODBUS cable is connected to the proper connectors (refer to *Figure 2* on **page 2**). Verify the COM port fields are properly set for ECT Modbus (19.2k baud, data size=8 bits, Parity=NONE, stop bits=1).

4. **Make sure Control Links were commissioned** - Press  followed by    on the E2 front panel and verify the offline Control Link module has a non-zero number in its Board# field. If the number in the Board/Node field is zero, highlight the controller name and select  - SET ADDRESS followed by  - Select Address. Then select the network ID that matches the setting on the network address DIP switch.
5. **Check Control Link network card DIP switch settings** - make sure switches 1-6 on the Control Link network card match the network ID number of the offline Control Link.
6. **Verify switches 7 and 8 are in the DOWN position** - Switches 7 and 8 in the DOWN position specify 19.2k baud and no parity. If either of these switches are not in the DOWN position, set them DOWN.
7. **Check network termination** - The two devices on either end of the MODBUS network should be terminated, with all other devices in the daisy chain unterminated. Check jumper settings for all devices on the network.

Problem: Configurations Out of Synch

1. **Check Config Synchronization Strategy** - Look at the Control Link device's E2 setup screens, and check the value of the CfgSyn Action field in the "Device" tab. If this field is set to "Manual Control," the configurations are out of synch because of changes to either the E2 or the Control Link setpoints that must now be manually synchronized. If this field is set improperly, change it to the strategy required by the site.
2. **Manually Synchronize** - From the Control Link device's status screen, press  followed by  - Application Commands. Select "Rcv Device Cfg to E2" to copy the Control Link device's setpoints to E2, or "Snd E2 Cnfg to Device" to write the E2's setpoints to the Control Link.

Problem: Setpoints Changed From The Control Link Are Not Being Saved

1. **Check Config Synchronization Strategy** - Look at the Control Link device's E2 setup screens, and check the value of the CfgSyn Action field in the "Device" tab. If this field is set to "Snd E2 Config to Device," this strategy does not allow changes made from the Control Link to be saved. E2 will overwrite all changes made from the Control Link keypad. Either make the necessary changes through the E2, or else change the synchronization strategy.
2. **Verify the SET button is being pressed** - After making any changes to a Control Link device's configuration, if the user does not press and hold the SET button for five seconds, the changes will not be saved.