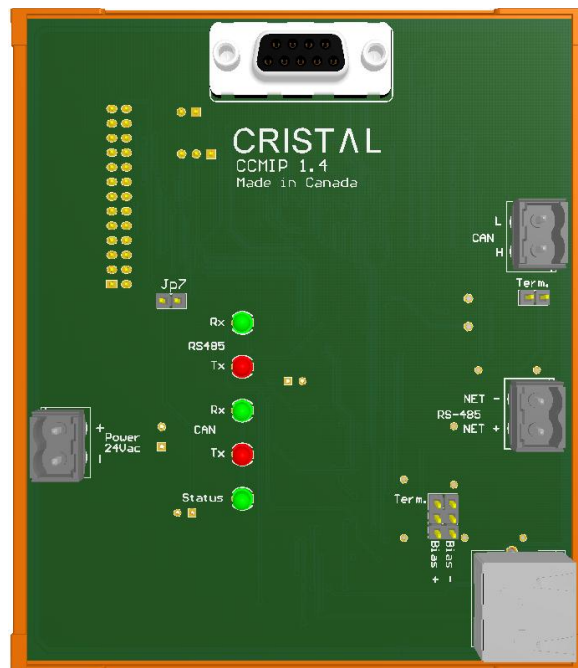


CRISTAL

CCLP-Modbus (Version 3.1.1)



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1. Product description

The CCLP-Modbus is a communication card designed to interface up to 4 Cristal Controls relays scanners model CCLS-4016 within a low-voltage lighting relay panel. With the CCLP-Modbus, CCLS-4016 are accessible from the Modbus protocol. CCLP-1664 terminology indicates a complete relay panel.

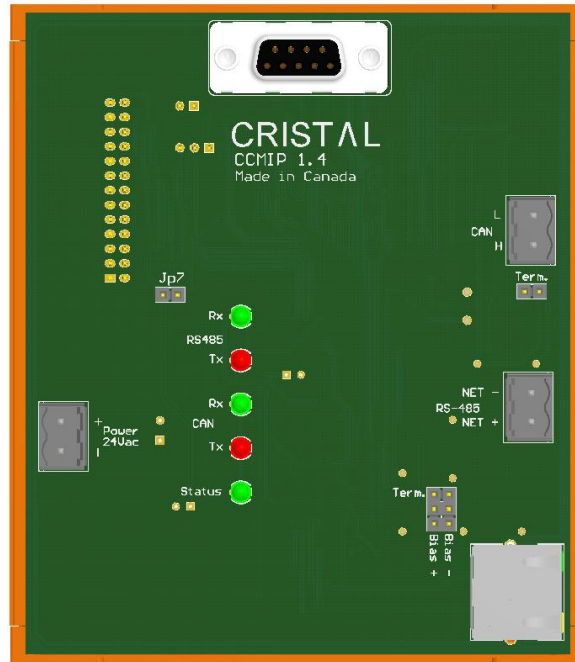


Figure 1 - PCB CCLP-Modbus

When control by the Modbus protocol, it will allow access to inputs (4.1) and relay outputs (4.2) through a list of “holding registers”. Relays can also be grouped (4.3).

2. Typical wiring

These guidelines must be followed when the CCLP-Modbus and CCLS-4016 relays scanners are installed on site. Wrong wiring may damage the CCLP-Modbus and the CCLS-4016.

2.1. *Power Supply*

The CCLP-Modbus controller and the CCLS-4016 relays scanners are half-wave power supplies. Each controller needs a 24 Vac supply and polarity must be the same on each controller. We recommend connecting the “negative” side of the power supply to earth “G” to comply with standards (such as CSA) or to make sure the controllers have all the same reference.

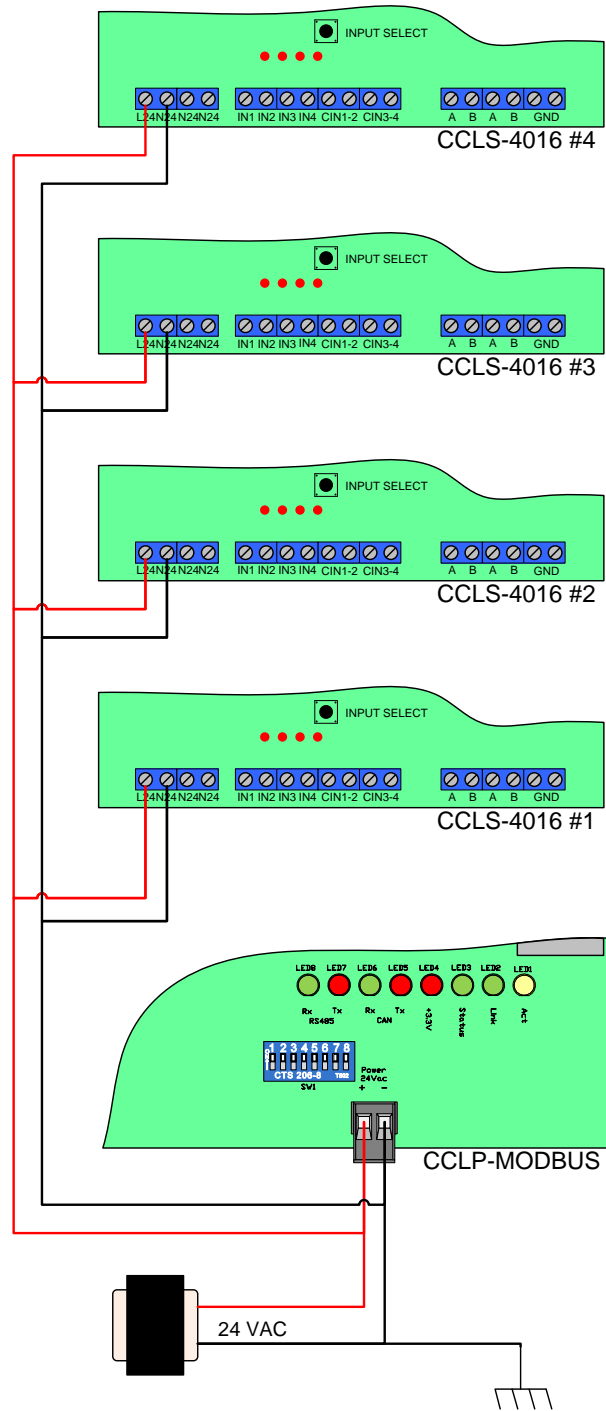


Figure 2 - Power supply wiring

2.2. Internal network (CAN)

The Modbus communication card retrieves states and sends commands to the CCLS-4016 relay scanner. All CCLS-4016 relay scanner use a CAN Network. This CAN network, needs to have a “bus” topology and 124-Ω terminating resistors at each end. Installing a jumper on the connector “Term” will enable the network-terminating resistor. Wiring polarity must be respected on each controller or communication failure will result and may also damage the CCLS-4016 relay scanner.

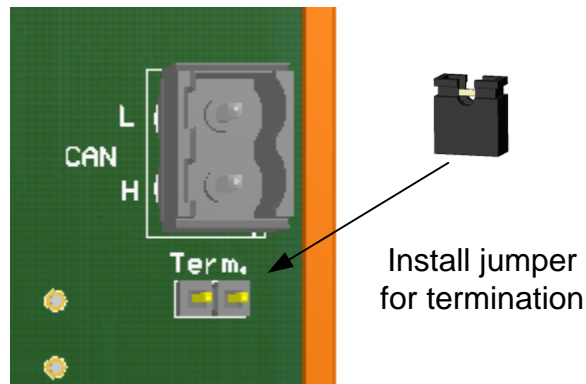


Figure 3 - CAN terminating resistor

This CAN network cannot be extended outside the relay lighting panel, as the extra wire length will decrease communication reliability.

Low capacitance cable for network communication such as Anixter 316-023-1802-FR-05 or Cerco Cable AT-HOM29 must be used.

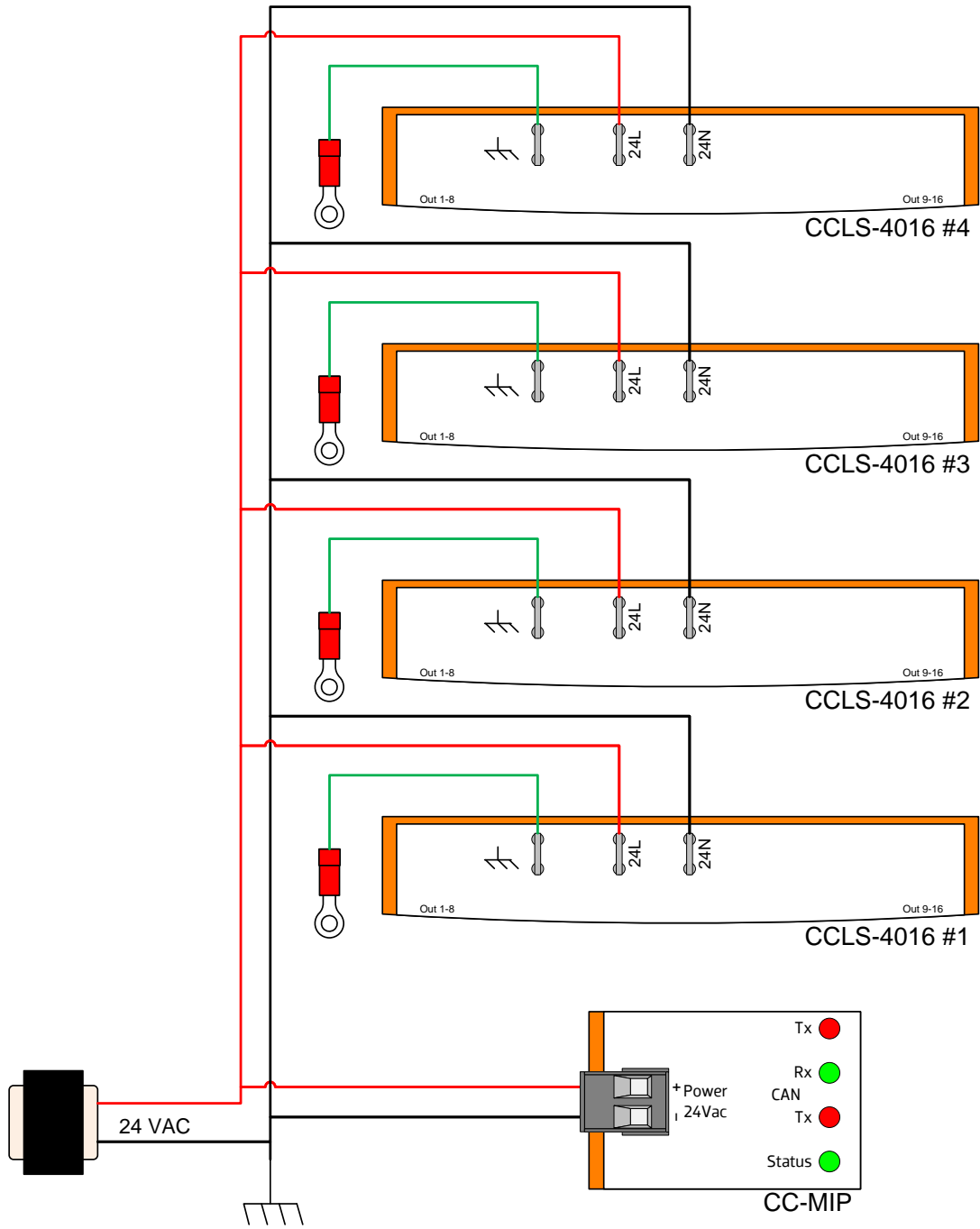


Figure 4 - CAN network wiring

2.3. Ethernet IEEE 802.3

Ethernet, the CCLP-Modbus uses a standard CAT-5 unshielded twisted cable with a RJ-45 connector. This is a dual-speed network communication card with auto negotiation capabilities for any 10 BASE-T (10 Mbits) or 100 BASE-T (100 Mbits) connections.

The auto negotiation procedure does not well mix on 1000 BASE-T (1000 Mbits) connections. The CCLP-Modbus network communication card shall be set at the same speed as the PC card in order to properly operate otherwise communication will fail.

Cat5 cable length shall not exceed 100m (328 ft). When longer distances are needed, refer to a specialized network partner to convert the network to alternative media such as fiber optic, DSL, or wireless.

2.4. RS-485 Modbus RTU slave

Verify certain aspects when RS-485 Modbus RTU network option is selected.

When the CCLP-Modbus is at the end of a RS-485 bus, installing jumper “Term” must activate the on-board 120- Ω terminating resistors. A 604- Ω biasing resistors may be enabled by installing jumpers “Bias A(+)” and “Bias B(-)”.

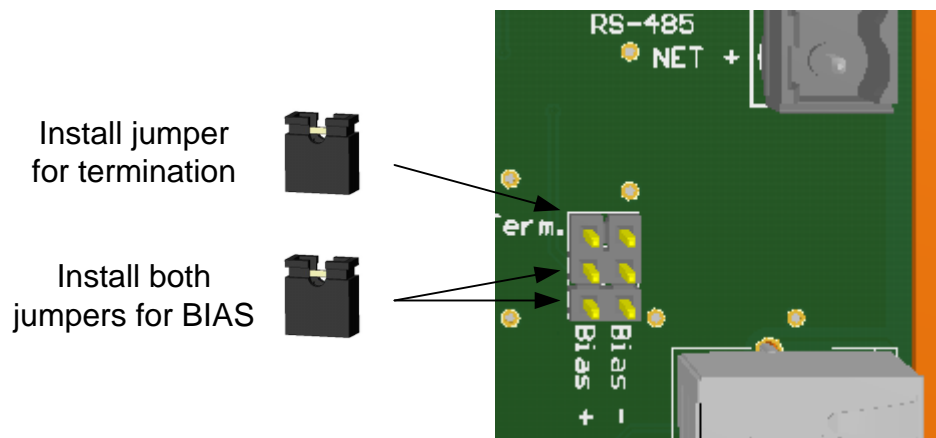


Figure 5 - RS-485 Bias and terminating resistor

For more information, refer to the Cristal Controls manual “Setting up a RS-485 Network”.

3. Configuration console

The serial port of the CCLP-Modbus is used for the initial configuration of the device. You can connect to the serial port using a standard straight DB-9 male to DB-9 female serial cable. [HyperTerminal](#) can be used. Hyper Terminal is available in most [Microsoft Windows](#) installations. If not available, you can download the free [PuTTY Terminal](#) software or buy commercial software such as [EmTec ZOC terminal](#).

Communication parameters need to be at 115200 baud, 8 bits of data, no parity and 1 stop bit. The computer needs to drive the DTR pin or the controller will ignore any serial port communication.

```
CCLP-1664-Modbus 3.1 Compiled on May 01 2012 14:33:48
Copyrights Cristal Controls Ltd.

OpenTcp stack v1.5.2
MAC Address: 00:50:C2:90:70:03
IP Address: 192.168.2.35
Subnet Mask: 255.255.255.0
Gateway: 192.168.2.1
```

On power up, you should see a lot of device information such as: software version, and IP configuration. The CCLP-Modbus is ready for the configuration and diagnostic.

3.1. *Various commands*

Help

This command displays the list of commands with some information about syntax and usage.

Show

This command displays information on IP configuration, Modbus configuration, and the hardware.

```
OpenTcp stack v1.5.3
MAC Address: 00:50:C2:90:70:03
IP Address: 192.168.2.35
Subnet Mask: 255.255.255.0
Gateway: 192.168.2.1

MODBUS ADDRESS: 1
MODBUS BAUDRATE: 9600
MODBUS DELAY: 0

Microcontroller: MCF52234
Flash chip: ST M25PE40 4Mbit
Ethernet Speed: Auto(100F)
```

The last line let you diagnose your Ethernet connection. It will display the speed of your Ethernet link if it is "up".

Version

Displays version information of the CCLP-Modbus and the CCLS-4016 relay scanner.

```
CCLP-1664-Modbus 3.1 Compiled on May 01 2012 14:33:48
Copyrights Cristal Controls Ltd.

Device #1: 3.000
```

Reboot

This command resets the CPU and restarts the program.

3.2. Ethernet and IP

IP

This command allows changing the IP address of the CCLP-Modbus or enables the usage of a DHCP server. Type this command with the needed IP address or the text dhcp.

```
ip 192.168.2.35
```

```
ip dhcp
```

When the IP address is set, you will be asked to “Reboot” the device so the changes to take effect.

WARNING: DHCP servers should be enabled only in test environment. In case of a DHCP server failure, the lighting relay scanner may become unreachable.

Gateway

This command is to replace the address of the default gateway. Set this command with the proper IP address. Usually, this is the IP address of your internet router.

```
gateway 192.168.2.1
```

Subnet

This command allows replacing the address subnet mask for the device. Set this command with the proper IP mask. All devices and computers should be set to the same value when on the same network.

```
subnet 255.255.255.0
```

EthSpeed

This command sets the speed to your Ethernet controller. Set with “10F”, “10H”, “100F”, “100H”, or “Auto”, depending on whether you want to set 10 MBits, 100 MBits, full-duplex, half-duplex, or automatic mode. It is safer to leave it to “Auto” but you may need to force the speed if connected to a 1 GB Ethernet device as there are some known incompatibility being “Auto” on a 1 GB link.

Ping

Ping another device on the IP network. Set with the destination IP address. This command is useful while doing diagnostics on IP network.

```
ping 192.168.2.10
Ping request sent
Ping reply received from 192.168.2.10
```

FecStats

This command shows various statistics of the Ethernet controller. These different counters could be used to diagnose the quality of the Ethernet connectivity.

3.3. Modbus

WARNING: A misuse of these settings can cause network communication problems of the CCLP-Modbus board and to other Modbus devices on the network. Consult your Modbus network administrator for the accurate parameters.

ModbusAddr

This command is to set the Modbus address. This number must be unique on the Modbus network and must be between 1 and 255. Follow this command with a decimal number for the address to be used.

ModbusBaud

This command is to set RS-485 serial communication speed. Set the desired baud rate. Available values are 9600, 19200, 38400, 57600, 76800, 115200, and 230400. Default value is 38400 baud this must be the same for all other devices on the same RS-485 network.

ModbusDelay

This command is to set a delay to Modbus responses setting. The parameter following this command is time (in milliseconds) with a default value of zero. It can be useful to increase this delay to allow slower master controllers to receive a complete reply.

ModbusCmdEvent

This command is to activate or deactivate event-driven commands. The parameter following this command is ON or OFF. When activated the relays and groups commands are executed each time. Deactivated the relays and groups commands are executed only on change.

ModbusStats

Display Modbus communication statistics.

Use this command with the “reset” parameter to clear Modbus statistics.

3.4. CAN

Redetect

This command forces the detection sequence for the CCLS-4016 relays scanners on the CAN network. This is normally done during manufacturing and is automatically done on power-up if no CCLS-4016 CAN addresses are defined for the relays scanner. This command will overwrite CCLS-4016 addresses in Modbus registers (4.4).

ShowCcls

This command displays an ASCII text file indicates firmware version information of the CCLP-Modbus and the CCLS-4016 relays scanners. It also indicates if some errors are detected from CCLS-4016 relay scanner communication side.

ClearLog

This command records all CCLS-4016 relay scanner events as seen on the CAN network. All events can be wiped and restart with an empty log when activating this command.

LogCan

You can control what type of CCLS-4016 relay scanner events will be recorded to the flash memory. By avoiding some type of information you can record other information for a longer period of time. Contact Cristal Controls if you need to use the logging feature of the CCLS-4016 relay scanner. Default setting, "no message is being logged".

The recorded log can be retrieved from an HTTP file transfer.

3.5. Lighting panel

Status

This command returns relay and input status of the whole panel.

Each relay is displayed with a single character. It can be '1' for ON, '0' for OFF, '2' for both ON and OFF status, 'F' for a faulty output without any status return, or 'X' when the CCLS-4016 is not present.

Each input is displayed with a single character. It can be '1' for ON, '0' for OFF, or 'X' when the CCLS-4016 is not present.

```
status
Relay Status
0           1           2           3           4           5           6
1234567890123456789012345678901234567890123456789012345678901234
01112011FFFFFFFFXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Input Status
0           1
1234567890123456
0000XXXXXXXXXXXX
```

Relay

This is to send some commands to relays. It may allow checking proper communication between the CCLP-Modbus and the associated CCLS-4016 relay scanner. Following this command with a relay number from 1 to 64 and the action "on", "off", or "flick". Sending a "flick" command activates the unoccupied mode (see section 4.2 Relays for more details).

```
relay 1 on
OK
relay 2 off
OK
relay 3 flick
OK
```

Group

This command has some sub-commands to alter the groups' configurations. It can also be changed from the Modbus registers 50001-50045 with the use of the ModBrowse software. For every command following, [group number] is from 1 to 8 and [relay number] is from 1 to 64.

To add a relay in a group, type "group [group number] add [relay number]".

```
group 1 add 1
```

To remove a relay from a group, type "group [group number] del [relay number]".

```
group 1 del 1
```

To remove all relays from a group, type "group [group number] clear".

```
group 1 clear
```

To see the list of relays inside a group, type "group [group number] print".

```
group 1 print
Relay(s) in group #1:  1 2 3 4
OK
```

When done configuring groups, some information has to be sent to the CCLS-4016 boards. Type "group commit" to do so.

```
Type group commit to apply changes
OK
group commit
OK
```

MasterCtrl

This command has a few sub-commands to change the setting from a master controller. When a master controller is set, we monitor if communication with this master controller is maintained. When the communication is lost, we disable the

schedule mode and apply command on the desired relays. Sub-commands follow.

- `initdelay` : Set the used delay after a reset of the CCLP-Modbus. This delay can be used to give more time to the master controller after a power loss. If the master controller does not read the CCLP-Modbus during this delay, we consider there is a communication problem.

```
masterctrl initdelay 900
OK
```

- `delay` : Set the inactivity delay for communication with the master controller after the initial message has been received from it.

```
masterctrl delay 300
OK
```

- `add/del on/off #relay`: indicates if an ON or OFF command must be applied after a communication with the master controller is lost. The « del » command deletes the relay from the ON or OFF list. A relay cannot be on both lists at the same time; when adding a relay to the ON list, it is automatically deleted from the OFF list and vice versa.

```
masterctrl add on 10
OK
```

- `del on/off #relay`: removes a relay from the list of those needed to be turned ON or OFF when communication is lost with the master controller.

```
masterctrl add on 10
OK
```

- print on/off : display relays from the selected list.

```
masterctrl print on
Relay(s) ON : 1 2 3 5 16 32
OK
```

- clear on/off : empty the relays list from the indicated list.

```
masterctrl clear on
OK
```

4. Communication – Modbus registers

The following table explains the Modbus "holding" registers list.

Address	Name	Min Value	Max Value	Default	Writable	Non volatile	Description
(4)0001	Program ID	-	-	112		X	Card model identification number.
(4)0002	Version	-	-	310		X	Version number.
(4)0003	Modbus Address	1	255	1	X	X	Modbus address.
(4)0004	Baudrate	-	-	9600	X	X	Modbus baud rate 96 = 9600 192 = 19200 384 = 38400 576 = 57600 768 = 76800 1152 = 115200 1536 = 153600 2304 = 230400
(4)0005	Options	0x0000	0xFFFF	0x0001	X	X	Allows activating / deactivating event-driven commands. When activated (0x0001) the relays and groups commands are executed every time. When deactivated (0x0000) the relays and groups commands are executed only on change.
(4)0051	Reset	0	1	0	X		Write to 1 to reset the card.
(4)0052	Redetect	0	1	0	X		Write to 1 to force the detection sequence for the CCLS-4016 boards on the CAN network.
(4)0101- (4)0104	CCLS-4016 Addresses 01-04	1	127	0		X	Can address of CCLS-4016 relay scanners.
(4)0111- (4)0114	CCLS-4016 Versions 01-04	0	65535	65535			Version of CCLS-4016 boards detected.
(4)0201- (4)0216	Input state 01-16	0 = OFF	1 = ON	0 = OFF			Current state of the programmable inputs.
(4)0217	Input state 01-16 (bit field)	0x0000	0xFFFF	0x0000			Current state of the programmable inputs. Each bit represents the

							status of an input.
(4)0221- (4)0236	Input Reliability 01-16	0	63	1			0 = No errors detected 1 = Initial value / Card missing.
(4)0301- (4)0364	Relays Feedbacks 01-64	0 = OFF	1 = ON	0 = OFF			Actual state of a relay.
(4)0365- (4)0368	Relays Feedbacks 01-64 (bit field)	0x0000	0xFFFF	0x0000			Actual state of a relay. Each bit represents the status of a relay.
(4)0401- (4)0464	Relays Reliability 01-64	0	63				0 = No errors detected 1 = Initial value 4 = Card is present but no relay is connected. 5 = Card detects an output feedback with positive and negative states at the same time. 6 = Card missing
(4)0501- (4)0564	Relays Commands 01-64	0 = OFF	1 = ON	0 = OFF	X		To send a command to a relay.
(4)0565- (4)0568	Relays Commands 01-64 (bit field)	0x0000	0xFFFF	0x0000	X		To send commands to relays. Each bit represents the commands of a relay.
(4)0601- (4)0664	Relays Flick 01-64	0 = OFF	1 = ON	0 = OFF	X		Send a flick warning command to a relay.
(4)0701- (4)0708	Groups Feedbacks	0	100	0			Feedback for the relays of a group. 0% = OFF, 100% = ON, other = mixed
(4)0709	Groups Feedbacks (bit field)	0x0000	0x00FF	0x0000			Feedback for the relays of a group. Each bit represents the status of a group. 0% = 0, more than 0% = 1.
(4)0721- (4)0728	Groups Commands	0 = OFF	1 = ON	0 = OFF	X		Send command to multiple relays.
(4)0729	Groups Commands (bit field)	0x0000	0x00FF	0x0000	X		Send command to multiple relays. Each bit represents the commands of a group.
(4)0731- (4)0738	Groups Flick	0 = OFF	1 = ON	0 = OFF	X		Send a flick warning command to multiple relays.
(4)0801- (4)0844	Groups Configuration	-	-	-	X	X	Allows access to the internal configuration of the groups. The ModBrowse software allows the

							configuration of the groups through these addresses.
(4)0851- (4)862	Master Configuration	-	-	-	X	X	Allows access to the internal configuration. ModBrowse software can change this configuration through these addresses.
(4)0901- (4)0964	Relays Configuration	-	-	-	X	X	Allows access to the internal configuration. ModBrowse software can change this configuration through these addresses.

4.1. Inputs

Registers 40201-40206 read inputs of the CCLS-4016 relay scanner. Registers 40201-40216 indicate one input status per register. Register 40217 allow reading all inputs at once. Registers 40221-40236 report errors from inputs.

4.2. Relays

Each relay can be access through many registers.

Registers 40301-40364 read one relay status per register, registers 40365-40368 reads a 16 relays group. Registers 40401-40464 reports specific errors detected from relays.

Writing registers 40501-40564 send individual relay commands.

Registers 40601-40664 allow sending flick warning commands on the relays and modify the occupancy mode of the relays if the relay's setting allows for the selected relay. Writing 1 in the register activates the unoccupied mode. When activating the unoccupied mode a flick warning sequence is sent to the relay with an ON status. No flick-warn sequence is sent on a relay with an OFF status. The warning sequence will issue an OFF action on the relay followed by an ON action one second later.

In unoccupied mode, a timer is activated when the relay is turned ON, the relay will automatically turn OFF after the set timeout delay. When a Flick Warn delay is set, a flick warning sequence is sent, the relay will turn OFF permanently after the Flick Warn delay. During the Flick Warn delay, the relay state can be

changed manually using the local low voltage switch (make an OFF command followed by an ON command) the relay will stay in ON until the next Timeout delay.

Writing "0" to the "flick" register will activate the occupied mode. The relay status will not change on writing; the relay status will change state only on a command.

When a master controller is set, the communication is permanently monitored and time from last message reception from the master controller is timed.

When the time is greater than inactivity time setting, all relays switch back to occupy mode.

4.3. Groups

Each relays group can be access with the registers 40701-40738. Up to 8 software groups can be created to access multiple relays at the same time. Group configuration can be set by "Mod Browse" software at registers 50001-50045 or from the console (3.5). Group commands may affect the schedule mode.

Registers 40721-40728 allow replacing the state of many relays within a group and control the occupied and unoccupied modes. By writing in the register, a command will be sent to all the relays within that group. The command sent to the group can also be limited to OFF only, ON only or both commands can be disabled.

Registers 40701-40708 allow reading the status of relays within a group. When all relays are OFF, the register is at 0.0%. When all relays are ON, the register is at 100%. If some relays are ON and some are OFF, the register will return the

percentage of relays with ON state. Register 40709 is a bit field showing status for all groups.

Registers 40731-40738 allow sending flick warning commands on multiple relays. Writing 0 to the register has no effect on the relays, writing 1 will issue a warning sequence on the relay. If the relay is OFF, the warning sequence has no effect. If the relay is ON, the warning sequence issue an OFF command on the relay followed by an ON command one (1) second later.

Occupancy mode can be set for each group. Sending an ON command through the "Group Cmd" register, the ON command is sent to the group and the occupied mode is activated for the relays within that group. Sending an OFF command to the group, the unoccupied mode is activated for relays within that group. In unoccupied mode, a timer is activated when a relay is turned ON and the relay will automatically turn OFF after the set Timeout delay of the group. A Flick Warn delay is set for the group, the flick warning sequence is activated and the relay will turn OFF permanently after the Flick Warn delay. During the Flick Warn delay, the relay state can be manually changed using the local Low Voltage switch (make an OFF command followed by an ON command) so the relay will stay in ON for another Timeout delay.

Sending a Flick command by writing "1" in the "Group Flk" register, a flick warning sequence is sent to relays that are part of the group and are ON. The relays will be turned OFF permanently after the FlickWarn delay of the group (if the FlickWarn delay setting is zero the relay will turn OFF without a flick warning sequence). The unoccupied mode is also activated for all relays within the group. When writing "0" the occupied mode is activated for the relays within the group and no command is sent.

4.4. CCLS-4016 Addresses

The registers 40101-40104 should match with the addresses displayed from the CCLS-4016 relay scanner boot sequence for appropriate communication within the relays panel.

These values should be used mainly for troubleshooting purposes, as they are auto-detected during manufacturing. You may need to write the CCLS-4016 relay scanner CAN addresses into these objects when replacing hardware or when launching the auto-detection sequence from the console (3.4). Those values are saved within the CCLS-4016 relay scanner eeprom non-volatile memory.

4.5. CCLS-4016 Addresses discovery

CCLS-4016 relay scanner address discovery can be restarted from the Modbus network. Use the “redetect” Modbus register (40052) to launch the CCLS-4016 relay scanner discovery the same way as the « redetect » command from the configuration console.

4.6. Master Controller

When a master controller is communicating with the CCLP-Modbus (relay panel), it is possible to set an inactivity delay to validate that this master controller is still in service. When this delay expires, the off-schedule mode for all relays is disabled. “ON” and “OFF” commands can also be applied on the relays.

Two delays are being used: the first one after the CCLP-Modbus startup and the second one after initial communication is established. On startups, a different






delay is used to let the master controller start and be ready for communication.
After the initial delay, the second delay is used.

5. Web Interface

The CCLP-Modbus controller has a web interface that can be used for diagnostics. Simply type the IP address of your controller into your favorite web browser.

If you select “Panel” from the top menu, you will see a large page showing all inputs and relays within the panel. It may help when troubleshooting communication problems.

Each color beside a relay or an input indicates its current status.

- | | | |
|-------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| Green |  | The input or relay is OFF. |
| Red |  | The input or relay is ON. |
| Pink |  | There is a fault with the relay as the CCLS-4016 detect both ON and OFF feedback signals. |
| Black |  | There is a fault with the relay as the CCLS-4016 cannot detect an ON or OFF feedback signal. |
| Gray |  | There is no communication with the controller or the controller is not installed. |

The web interface has a JavaScript and automatically refresh its state every 5 seconds.

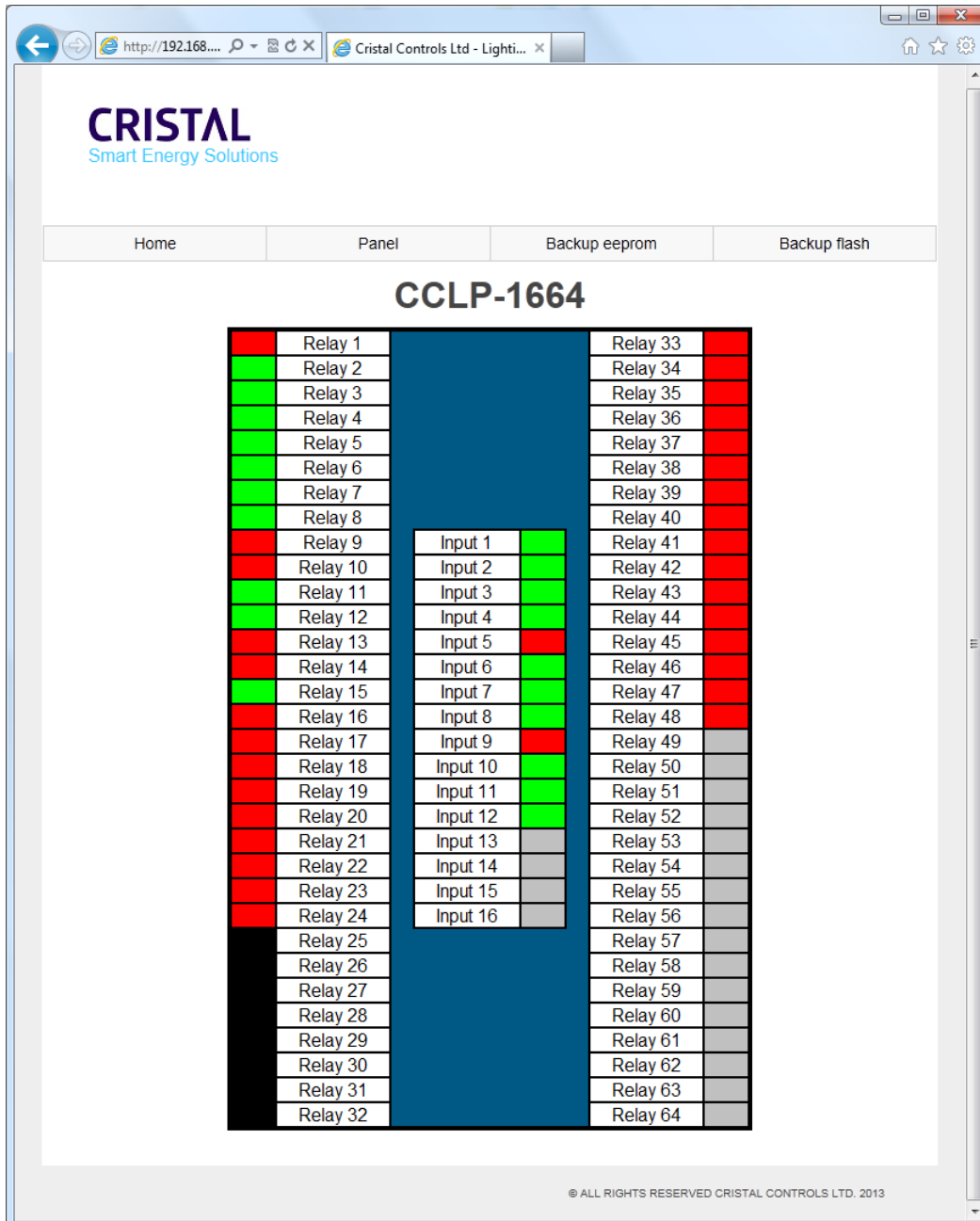


Figure 6 - Web panel interface

6. Hardware specifications

- Microcontroller : Freescale MCF52234
- Communication : Ethernet, Tcp-Ip, Can, and Modbus RTU.
- Supply : 18-30 Vac Half wave
- Power supply : 175 mA typical, 200 mA max
- Operating temperature : 0°C à 50°C (32°F à 122°F)
- Storage temperature : -20°C à 70°C (-4°F à 158°F)
- eeprom configuration storage : 512 bytes, 1 000 000 write cycles
- flash memory log storage : 512 kbytes, 100 000 write cycles

6.1. LED

The led “Status” (LED3) should blink at 1 Hz when the CCLP-Modbus is normally operating. Other LED indicates communication activity respectively for RS-485, CAN, and Ethernet.

6.2. Dip switches

Dip switches are reserved for a future use.

6.3. Jumpers

Beside the CAN terminals, the jumper “Term.” can enable or disable the 124-Ω terminating resistor.

Beside the RS-485 terminal, the jumper “Term.” can enable or disable the 120-Ω terminating resistor. Also, the jumpers “Bias A(+)” and “Bias B(-)” can enable or disable the biasing resistors.

6.4. Dimensions

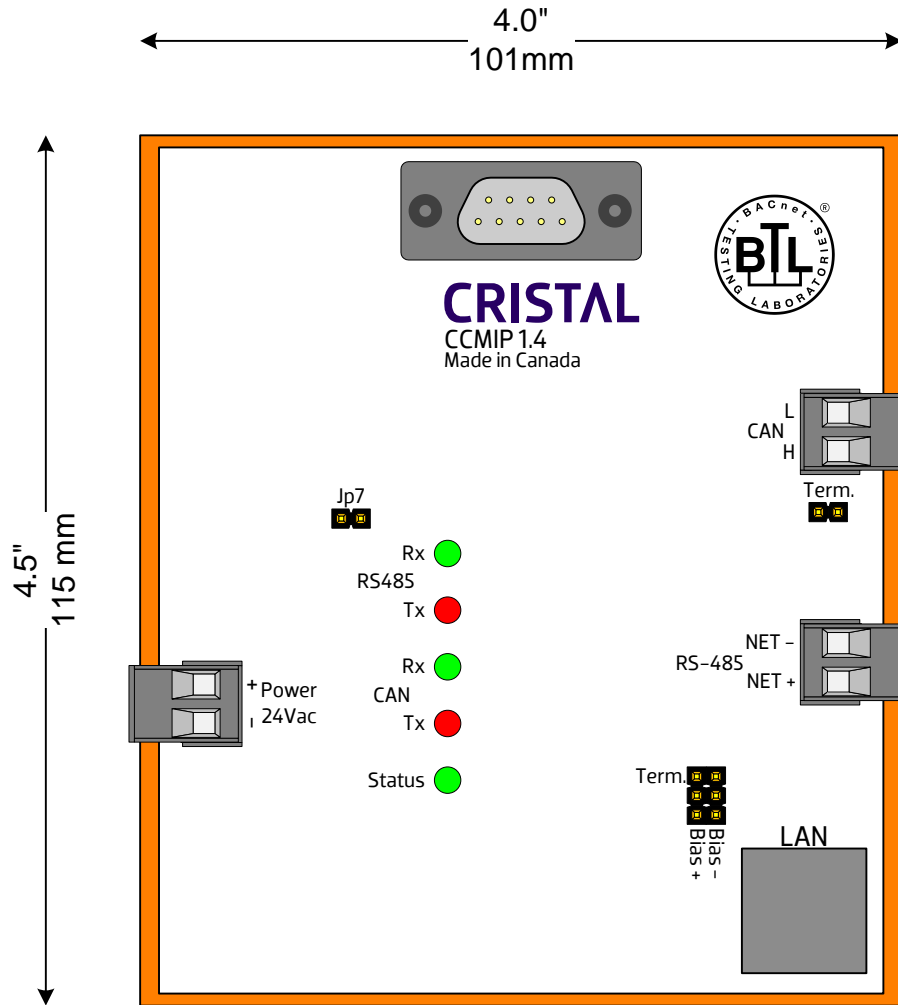


Figure 7 - Dimensions

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CRISTAL

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