

***MCN Monitoring and Control Network
Comparator Display System***

***Channel Control Unit
CCU-2
Hardware Reference Manual***

S2-61424-100

Note:

***Switch settings vary
depending upon the system.***

***Be sure to verify switch settings
before installation***

***Be sure to set the rotary address switches to the
proper addresses before installing the system.***



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This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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1. Introduction

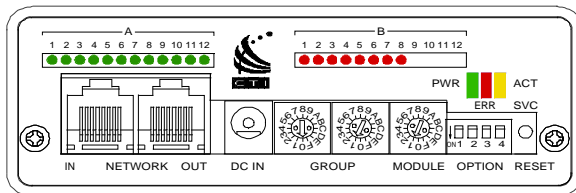
The CCU-2 Channel Control Unit is used to control functions in a Land Mobile Radio System such as:

- Main / Standby System Selection

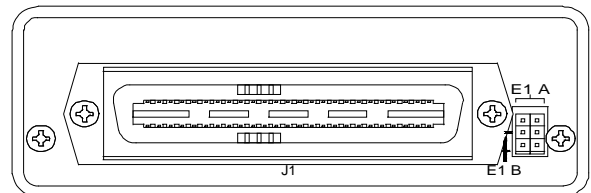
The CCU-2 module allows up to six independent consoles to control a common function. It allows all the consoles to force the function to Main or Standby and provides feedback to the consoles to indicate the state of the function. If one console fails, the other may continue to control the system functions.

The CCU-2 module provides status indication of each function on the MCN (Monitoring and Control Network), similar to a CIB module. It also allows the function to be forced from a PC running the MCN Remote Comparator Display (MCNRCD) software.

The CCU-2 module is an MCN GPIO-1208L General Purpose I/O Module with special firmware.



Front View



Rear View

CA-80851-100

Figure 1 – CCU-2 Module

1.1 Reference Documents

1. Monitoring and Control Network System Manual
 Part Number S2-60425

2. Specifications

Size	5.5" x 4.2" x 1.5" (140 x 107 x 38 mm)
Weight	19 oz (540 gm)
Temperature	0 – 50 °C
Humidity	10 - 95% non-condensing
Module Power	+15 to +30 VDC
Inputs	6 sets of Force A & Force B inputs Opto-isolated, unidirectional. External voltage required.
Input Levels (across inputs)	Inactive: < 0.5 VDC across inputs Active: 5 to 30 VDC
Input Trigger Transition Polarity (Force A or Force B)	On leading edge (from Inactive to Active)
Fault Tolerance	A proper input transition on a Force A or Force B input will override other inputs, even those stuck active.
Input Impedance:	5 K Ohms, min
Number of Sections Supported	1 Section
Outputs (for control or feedback)	8 Form C Relays, magnetically latched. All driven in parallel
Output Contacts	Bifurcated, Gold flashed Low level (20 uA, 20 mV) to 24 VAC/VDC, 1 A Max., Resistive Contacts used in applications which cause contact arcing (typically inductive, capacitive, or lamp circuits or circuits with over 12V and 250 mA) will not be suitable for switching low level signals.
Maximum Power Dissipation	2 Watts
Input/Output Connection	50 pin Telco style
Network Connector	(2) RJ-45 (1 in, 1 out)

Table 1 - Module Specifications

3. Inputs & Outputs

Figure 2 shows the equivalent circuits of the CCU I/O pins.

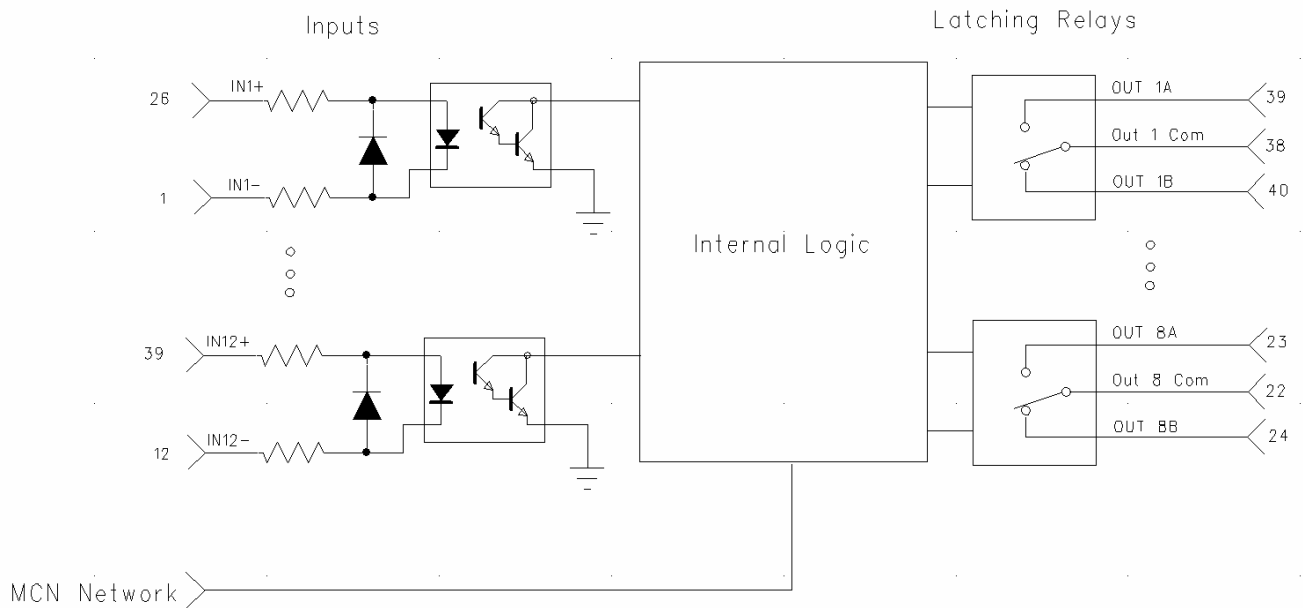


Figure 2 - I/O Equivalent Circuit

The function of the 12 inputs is as follows:

Input	Function
1	Force A 1
2	Force A 2
3	Force A 3
4	Force A 4
5	Force A 5
6	Force A 6
7	Force B 1
8	Force B 2
9	Force B 3
10	Force B 4
11	Force B 5
12	Force B 6

Outputs are pinned out so that adjacent relays can control audio pairs.

4. Theory of Operation

The CCU-2 contains the following:

- A Single Latching Section with 8 Form C Outputs
- (6) Force A Inputs
- (6) Force B Inputs

4.1 Latch Action

The latch is set to the A or B position by the Force A and Force B inputs as follows:

Input	Transition	Latched State
Force A x	Inactive to Active	A
Force B x	Inactive to Active	B

The CCU-2 will take action only on a transition of an input from Inactive to Active. If an input is stuck Active or Inactive, it will not prevent another input from switching the state of the latch. This provides fault tolerance for stuck (or open) inputs.

Since the relays are magnetically latched relays, they will hold their state even when the power to the CCU-2 module is off. Upon Power-up or Reset, the CCU will ignore the inputs for approximately 1 second to allow the inputs time to settle.

Status bits provide feedback to PCs on the MCN network. Depending upon the Display Table used for the particular function, the state of the output(s) and / or the input(s) can be seen.

Control bits provide input from PCs on the MCN network. Depending upon the Display Table used for the particular function, the operator may force the latch to the A or B state.

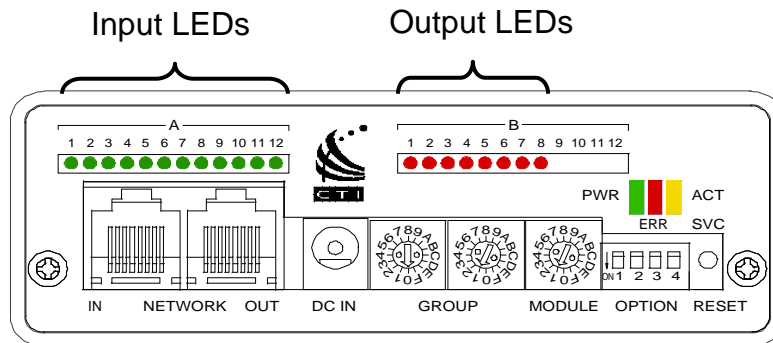
4.2 Redundant Path Applications

Since there are 6 pairs of inputs, the CCU-2 may be used in applications that have multiple paths for the Force A and Force B signals. For instance, you could set up three consoles with redundant paths as follows:

Console	Path	Force A Input	Force B Input
1	Forward	ForceA1	ForceB1
1	Reverse	ForceA2	ForceB2
2	Forward	ForceA3	ForceB3
2	Reverse	ForceA4	ForceB4
3	Forward	ForceA5	ForceB5
3	Reverse	ForceA6	ForceB6

4.3 LEDs

The CCU-2 has input and output LEDs.



4.3.1 Input LEDs

The left-side "A" LEDs are the input LEDs, one for each input.

- LED On Input Active
- LED Off Input Inactive

The input LED mapping is as follows:

LED	Function
A1-A6	ForceA1 – Force A6
A7-A12	ForceB1 – ForceB6

The input LEDs will all blink on upon power-up as a self-test.

4.3.2 Output LEDs

Output LEDs indicate the state of each of the 8 outputs:

- LED On Output A
- LED Off Output B

Since all relays are driven to the same state, the output LEDs should be all on or all off.

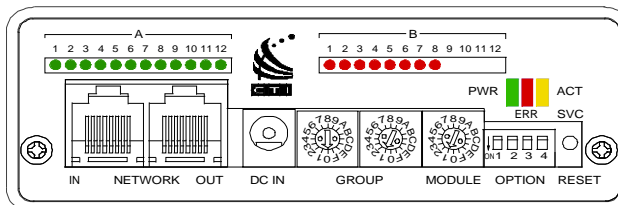
4.3.3 PWR, ERR, ACT LEDs

The CIB has three additional LED indicators on the front panel.

- PWR On when sufficient power is present
 Blinks when the voltage is low.
- ERR 1 Blink: Group:Module set to FF:F (Invalid address)
 2 Blinks: Improper internal daughter boards detected
 Solid On: Other error (hardware or software)
- ACT On: Connected to a PC running MCNRCD software

5. Option Switches & Jumpers

Addressing and option switches are provided for module configuration. The module must be power cycled or reset after these switches are set so that the options will take effect. Press the Reset toggle switch down to reset the module.



5.1 Group & Module Switches

The Group and Module rotary selector switches are used to set the node address during module installation. Each module must have a unique Group:Module address. Refer to the Monitor and Control Network System Manual for details about address planning or the Custom System Configuration documentation for pre-assigned addresses if your system is a Custom Engineered system.

SWITCH	DESCRIPTION	DEFAULT
GROUP	unit address setting (00-FE) refer to the MCN System Manual	00
MODULE	unit address setting (0-F) refer to the MCN System Manual	0

Table 2 – Group & Module Switches

5.2 Option Switches

The Option switches allow the technician to pre-set the relay outputs.

OPTION SWITCH	DESCRIPTION	Notes	Default
1	Not used		Down
2	Not used		Down
3	Reset Initial State	See Table 4	Down
4	Reset Initialize Enable	See Table 4	Down

Table 3 - Option Switches

Option Switches 3 & 4 are used to select the initial state at power-up and reset:

SW3	SW4	Initial State on Power Up or Reset	Default
Down	Down	Do not re-initialize. Use last stored state.	X
Up	Down	Do not re-initialize. Use last stored state.	
Down	Up	Initialize to State B (LEDs Off)	
Up	Up	Initialize to State A (LEDs On)	

Table 4 – Initial State on Reset

5.3 Initializing the Relays

The relays in the CCU-2 are magnetically latched and will retain their state when power is off. The normal state will be all On or all Off.

If the relays come up in a random pattern when the power is initially applied, it is probably because the relays were jarred during transport or installation.

There are two ways to initialize the relays:

1. Use the normal Force A or Force B inputs to set the latch to state A or B. This is easiest way to initialize the relays if you have the CCU connected to the system.
2. Use the front panel switches to initialize the relays. You can use this method if you don't yet have the CCU-2 connected in the system.

5.3.1 Initializing the Relays with the Front Panel Switches

To initialize the relays to state A:

1. Set switches as follows:
3 Up 4 Up.
2. Press the Reset Switch down and wait for 2 seconds.
3. The CCU-2 (and all the relays) should go into State A. All the output LEDs should be **On**.
4. Set switches as follows:
3 Down 4 Down
5. Press the Reset Switch down and wait for 2 seconds.
6. The CCU-2 (and all the relays) should STAY in State A. All the output LEDs should be **On**.

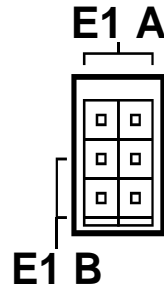
To initialize the relays to state B:

1. Set switches as follows:
3 Down 4 Up.
2. Press the Reset Switch down and wait for 2 seconds.
3. The CCU-2 (and all the relays) should go into State B. All the output LEDs should be **Off**.
4. Set switches as follows:
3 Down 4 Down
5. Press the Reset Switch down and wait for 2 seconds.
6. The CCU-2 (and all the relays) should STAY in State B. All the output LEDs should be **Off**.

Both procedures assume that you want the CCU-2 to maintain the last state on power up. If you want the CCU-2 to always start up in State A or State B, use the appropriate switch settings from table Table 4 in steps 4 above.

5.4 Jumper Options

Figure 3 shows the jumper options on the rear of the unit.



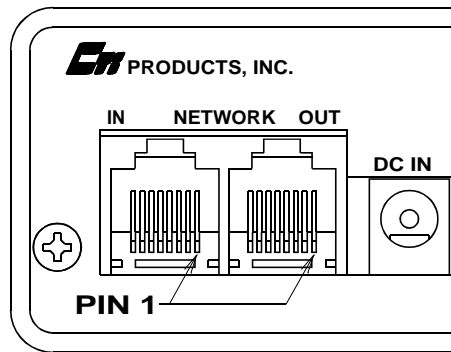
CA-80024-100

Figure 3 - Jumper Options

Neither of the jumper positions is connected on this unit.

6. Connectors

The **NETWORK IN/OUT** ports on the front of the CCU are used to connect the CCU with other MCN modules. These ports carry both the network data signals as well as DC power for power distribution with other modules. Table 5 gives the pinout for these connectors. Figure 4 shows the location of pin 1 for each port.



CA-80068-100

Figure 4 - Network IN/OUT Ports

Pin	Function
1	DATA +
2	DATA -
3	+ POWER
4	No Connect
5	No Connect
6	- POWER
7	- POWER
8	+ POWER

Table 5 - Network Connector Pinout

The **DC IN** port provides the primary power connection to the module. Power is distributed through the **NETWORK OUT** connector to provide power to the **NETWORK IN** connector of the MCN unit it is connected to. Each power supply can power up to four units total. See reference 1 for complete details of connections to the network and DC IN connectors.

The Network In connector can be used for input power even if the CCU-2 module will not be connecting to a PC. Be sure that its Group & Module address are set so that the address doesn't conflict with any other modules in the system.

6.1 J1 50-Pin Connector Pinout

Connector J1 provides the discrete I/O signals.

The following tables show the pinouts in Punch-Block order.

J1 Pin	In/Out	CCU-2 Module Signal	Front Panel LED
26	In	Force A1+	A1
1	In	Force A1-	A1
27	In	Force A2+	A2
2	In	Force A2-	A2
28	In	Force A3+	A3
3	In	Force A3-	A3
29	In	Force A4+	A4
4	In	Force A4-	A4
30	In	Force A5+	A5
5	In	Force A5-	A5
31	In	Force A6+	A6
6	In	Force A6-	A6
32	In	Force B1+	A7
7	In	Force B1-	A7
33	In	Force B2+	A8
8	In	Force B2-	A8
34	In	Force B3+	A9
9	In	Force B3-	A9
35	In	Force B4+	A10
10	In	Force B4-	A10
36	In	Force B5+	A11
11	In	Force B5-	A11
37	In	Force B6+	A12
12	In	Force B6-	A12
38	Out	Output 1 Com	B1
13	Out	Output 2 Com	B2
39	Out	Output 1 A	B1 (On)
14	Out	Output 2 A	B2 (On)
40	Out	Output 1 B	B1 (Off)
15	Out	Output 2 B	B2 (Off)
41	Out	Output 3 Com	B3
16	Out	Output 4 Com	B4
42	Out	Output 3 A	B3 (On)
17	Out	Output 4 A	B4 (On)
43	Out	Output 3 B	B3 (Off)
18	Out	Output 4 B	B4 (Off)
44	Out	Output 5 Com	B5
19	Out	Output 6 Com	B6
45	Out	Output 5 A	B5 (On)
20	Out	Output 6 A	B6 (On)
46	Out	Output 5 B	B5 (Off)
21	Out	Output 6 B	B6 (Off)
47	Out	Output 7 Com	B7
22	Out	Output 8 Com	B8
48	Out	Output 7 A	B7 (On)
23	Out	Output 8 A	B8 (On)
49	Out	Output 7 B	B7 (Off)
24	Out	Output 8 B	B8 (Off)
50	nc		
25	nc		

7. Mounting

Various mounting kits are available to mount the CCU-2 module.

Mounting Kits	
Rack Mount - 4 A size modules 1 Rack Unit (1.75") High	S2-60435
Rack Mount - 2 A size modules plus 1 B size module 1 Rack Unit (1.75") High (Used to mount 2 CCUs and 1 EXB module.)	S2-60443

Refer the reference 1, section *Mounting Options*, for physical details about mounting the CCU module.

8. Operation in an MCN Network

The CCU-2 module can operate in stand-alone mode with just connections to its 50 pin I/O connector and no connection to the MCN network. However, if it is used in a system with one or more PCs running MCNRCD software it may be monitored & controlled from those PCs.

A special set of Default files is available for use with MCN Config configuration program for the CCU-2. Special items include:

Module Type: CCU-2
 Display Tables CCU Input A, CCU Input B, CCU Output

The CCU Module configuration will include the following I/O points in the MCN Config program:

I/O Point	Name	Display Table
1	Force A 1	CCU Input A
2	Force A 2	CCU Input A
3	Force A 3	CCU Input A
4	Force A 4	CCU Input A
5	Force A 5	CCU Input A
6	Force A 6	CCU Input A
7	Force B 1	CCU Input B
8	Force B 2	CCU Input B
9	Force B 3	CCU Input B
10	Force B 4	CCU Input B
11	Force B 5	CCU Input B
12	Force B 6	CCU Input B
13	Output 1	CCU Output
14	Output 2	CCU Output
15	Output 3	CCU Output
16	Output 4	CCU Output
17	Output 5	CCU Output
18	Output 6	CCU Output
19	Output 7	CCU Output
20	Output 8	CCU Output

The inputs will show the state of the external Force A and Force B inputs.

The output points will show the states of the 8 relays. (All relays should show the same state).

The state of the latch may be changed by forcing one of the outputs on or off as follows:

MCN State	CCU-2 Latch State
On	A
Off	B

9. Troubleshooting

This table is a list of troubleshooting tips specific to the CCU-2 module. For additional troubleshooting tips, refer to the troubleshooting section found in the *Monitoring and Control Network System Manual*, reference 1.

Due to the high percentage of surface-mount components, the CCU is treated as a field replaceable unit. If any system problems are the result of a malfunctioning CCU unit, the entire unit must be replaced and returned for repair.

PROBLEM	CAUSE
The PWR LED flashes	The input DC voltage is low. You may have too many modules in line. There is a voltage drop in each module and the downstream modules will each see a lower DC voltage.
The ERR LED flashes once	The Group & Module switches are set to FF:F. This is an invalid address. Set the Group & Module switches to the proper address for your system and press the Reset switch down.
The ERR LED flashes twice	The CCU-2 has not detected the proper internal daughter boards. Call the factory for an RMA.
The ERR LED is on solid	Internal hardware or firmware error. Call the factory for an RMA.
Input LEDs are stuck on	An input may be stuck active. Remove the 50-pin I/O connector. If the input LED goes off, your problem is external to the CCU. If the input LED remains stuck on, there is an internal problem in the unit. Call the factory for an RMA.
The Output LEDs (and relays) come up in a random state on initial power-up	The relays may have been jarred during transport. Initialize the relays as described in section 5.3, Initializing the Relays above. If this problem persists and is not due to mechanical shock on the relays, it indicates an internal problem. Call the factory for an RMA.
One of the output LEDs does not switch with the others	There is an internal problem in the unit. Call the factory for an RMA.

PROBLEM	CAUSE
The CCU doesn't hold the last state on power-up or reset	<p>Check Option Switch 4. If it is up, the CCU will initialize this state based upon Switch 3. See Table 4 – Initial State on Reset.</p> <p>Set Switches 3 & 4 Down and reset the unit.</p>
The CCU holds the last state on power-up (and we need it to come up in a known state)	<p>Check Option Switch 4. If it is down, the CCU will start up using the previous state. If you need it to start up in a known state (A or B), set the proper state on Switches 3 & 4 and reset the unit. See Table 4 – Initial State on Reset for details.</p>
The PC shows the receivers from this CCU-2 module as "Offline".	<p>Check the MCN cabling. Also check that the CCU-2 address and the address for the CCU-2 module in the PC database match.</p> <p>In an engineered system (with routers and/or EXB modules) the PC may have an improper address or the module might be installed on the wrong MCN sub-network. Check the custom system documentation for the proper settings and connections.</p>
The ACT LED on the CCU is off	<p>If you don't have a PC talking to the CCU module this is normal.</p> <p>If you do have a PC that needs to connect to the CCU module, try the suggestions in the "Offline" problem above.</p>

