

IOCOMx User Manual

Developer's manual and installation manual

The IOCOMx device transmits and receives switch states between sender and receiver, and operates a relay based upon the state of the remote switch. An individual system is capable of both transmission and reception simultaneously.

The IOCOMx system may consist of several, separate devices (modules). Each module can take care of eight individual channels, and up to eight modules can be grouped into a system. This results in total capability of 64 channels. If desired, less modules may be grouped. There are no system coexistence limits, multiple systems may be deployed in the same airspace.

Up to eight IOCOMx modules can be connected to a single bus in a single system. The modules receive an ordinal number from configuration, and the ordinal number determines the range of switches this module will represent in the transmit / receive process.

Communication Schematic

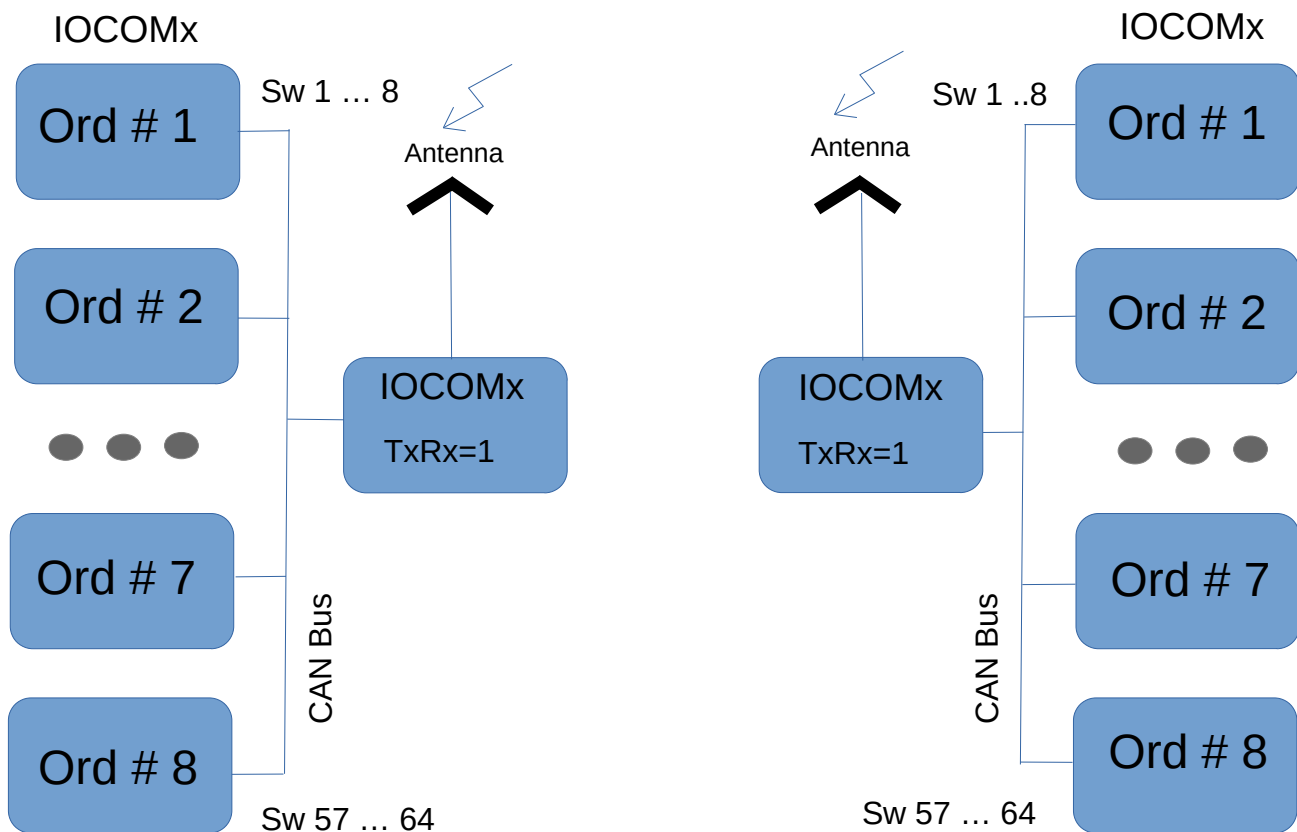


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Introduction

Within the limit of eight, any number of IOCOMx modules can be grouped into one system. The following table contains the chart of modules and their corresponding port ranges.

Module Count	Ordinal	Port Total	Port Ranges
1	1	8	1-8
2	2	16	1-8; 9-16;
3	3	24	1-8; 9-16; 17-24;
4	4	32	1-8; 9-16; 17-24; 25-32;
5	5	40	1-8; 9-16; 17-24; 25-32; 33-40;
6	6	48	1-8; 9-16; 17-24; 25-32; 33-40; 41-48;
7	7	56	1-8; 9-16; 17-24; 25-32; 33-40; 41-48; 49-56;
8	8	64	1-8; 9-16; 17-24; 25-32; 33-40; 41-48; 49-56; 57-64;

The **IOCOMx** receives and decodes signals, and pulls / releases relays based upon the content of the received transmission. The transmission is omnipresent, the reception is selective. This allows that any number of receivers can listen to the transmitting device. It also permits that additional tools to be deployed, which may monitor communications for expansions like statistics / accounting. The communication is encrypted, without the proper key and decryption algorithm it is not feasible to decode communications.

IOCOMx Pairing

The IOCOMx system comes paired from the manufacturer. Should (re) pairing be needed, Double click (press 2 times) the configuration button on the face of the **Transmitter** unit, and triple click (press 3 times) the configuration button on the **Receiver** unit. The devices will communicate and pair.

During the pairing process, the unit's LED will flash on and off. When the Receiver is successfully paired the pairing LED will flash rapidly five times. If no pairing request is completed, the pairing mode will time-out in 15 seconds.

Note, that this configures the communication one way, from transmitter to receiver. If you would like to configure the devices for bi-directional communication, repeat the process with the order of double click / triple click reflecting the reverse communication direction.

Setup via Web Page

The IOCOMx system starts up in transmit / receive mode. To enter configuration mode, quad click (click 4 times) the configuration button. (the timing of the click is similar to the mouse 'double' click, but instead of two clicks, click it four times)

The Config. LED will flash on and off slowly to signify that the device is in configuration mode. One may connect to the device's web page, and configure it. If no web communication activity occurs in one minute, the device will terminate the configuration mode, and resume operation in regular communication mode.

Pairing Protocol

Both the receiver and transmitter must be in the appropriate pairing mode. The receiver cannot be paired if the number of devices has reached the pairing limit (the limit is currently: four) If you encounter difficulty during the pairing process with the Receiver, a long press of 10 seconds will reset the receiver and will clear all pairing data, and allows a fresh start *Note that after the long press all the other devices that were paired to this receiver need to be re-paired.

Web Page Setup, Enable Configuration

The IOCOMx system starts up in transmit / receive mode. To enter configuration mode, quad click the configuration button.

The LED will flash on and off slowly to signify that the device is in configuration mode. One may connect to the device's web page, and configure it. If no web communication activity occurs in one minute, the device will terminate the configuration mode, and resume in communication mode.

Setup Option for Repeat interval:

While any of the Input commands are being provided the IOCOMx Transmitter unit, it will transmit the ON signal periodically. This timing can be adjusted via the 'Repeat Interval' setting on the main page. This setting auto adjusts the 'Auto Release' timing of the receiver to match the transmitted delay.

Setup Option for Repeat count:

When an Input Command is removed, the IOCOMx sends a burst of 'OFF' commands. This is in anticipation of lost packets, so the 'OFF' signal arrives safely to the receiver. The number of repeated 'OFF' packets defaults to three. It can be set between 1-12, the factory default for this option is set to 1 (most battery friendly), set to larger values if lost packets are encountered or anticipated.

Network Name Configuration:

The network configuration fields determine the Station Name and Password of this IOCOMx. The device will appear on your WiFi network by this name. For safety and security, the IOCOMx may be configured with a password. The password needs to be at least 8 characters or longer. Please avoid using space, punctuation marks and non ASCII characters. You may use the _ (underscore) - (minus sign) and the + (plus sign).

If you encounter difficulty during the password change process, a long press on the configuration button (press and hold for appx. 10 seconds) will reset the receiver and will clear all password. This reset will also clear the pairing data, the existing pairings will need to be re-paired.

General Configuration:

The device can be named, and this name is provided to give the device an identifier. It can be any name, a stock number or the name of the device it controls. This name does not participate in any network parameter or communication process, it is simply to identify this device.

Battery Voltage:

The Transmitter unit deploys a 3.6V 8Ah, Non Rechargeable Lithium Battery. In the IOCOMx device, the low battery threshold indicators light up at 3.2V and below, recommending a battery replacement. There are no battery related shut offs, the device will remain operational until power is exhausted. The measurement value shown on the page taken at the loading of the page. (Note: this field is specific to the battery operated unit)

Technical Details:

Encryption and Checksum:

The IOCOMx system communicates with an encrypted data stream. Listening to the data with external devices yields the appearance of random data. As every packet is different, the operational intent is not decipherable without the correct encryption key. The data packet is also protected with a checksum and will reject packets with an invalid checksum.

Configuration Button codes:

The configuration button has multiple functions. A single click wakes up the system, if it is in sleep mode, otherwise it is a no-op (does nothing). A double click starts the pairing process on the transmitter. The pairing process times out in 15 seconds. A triple click starts the pairing process on the receiver side. This has similar properties as the transmitter counterpart, times out in 15 seconds. A quad click (4 clicks) starts the configuration web page. A second set of quad clicks stops the web configuration process. The web configuration mode stops if there is no web activity for one minute. A penta click (five clicks) reboots the device.

Press and hold configuration button to reset the device to manufacturer's defaults. The parameters are reset to their original values, and the Network Name is reset to IOCOM-XXXX where XXXX is part of the MAC address of the device. The network password is reset to 12345678

LED codes:

The indicator LED has multiple functions. At its fundamental function it will flash when an ON transmission occurs. If the device detects low battery the indicator will flash in red. If the device is in pairing mode the LED will flash on and off during pairing process. If the device is in Configuration / Web mode, the LED will flash slowly on and off during Configuration / Web mode. If there are any error conditions, the LED will flash rapidly for a short period of time. (led strobe mode)

Pairing Diversity:

The IOCOMx can be paired with four other devices. With the IOCOMx transceiver device, the pairing direction is established by the button press order: the double click names the unit internally as the Transmitter initiate, the triple click is Receiver initiate. As one IOCOMx device can accommodate four paired devices, it is possible to configure many combinations of control networks. For instance, up to four transmitters can be configured to control one receiver. In another instance, one transmitter may control four (or more) receivers simultaneously. The combination of control is not limited in any way beyond the receiver's maximum pair count.

Recovery:

A long press of 10 seconds will reset to manufacturer's defaults. Network Name is reset to IOCOM-XXXX and the network password is reset to 12345678

Transmit Power Configuration:

The IOCOMx battery powered transmitter can save battery life by reducing transmission power. The power can be set in seven steps, from Low to High, Left to Right.

<i>Low Power</i>		<i>Medium Power</i>		<i>High Power</i>		
2dBm	5dBm	7dBm	11dBm	14dBm	16dBm	20dBm

Repeat Interval for the ON signal:

While the button is pressed, and held, the transmitter repeats a 'keep alive' signal. This is how the receiver detects that the button is still pressed. The timing of the interval is in milli seconds. Manufacturer's defaults are chosen to work in most situations.

200 ms	300 ms	500 ms	700 ms
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Repeat Count for the OFF Signal:

When any control button is released, the transmitter transmits the 'OFF' signal several times. This configuration item determines the number of times the signal is repeated. Manufacturer's defaults are chosen to work in most situations.

1x 2x 3x 5x 8x 12x

Please remember to press the 'Save Configuration' button to commit your changes. All Save buttons save items for the whole page.

IOCOMx Transceiver; Advanced Settings

Receiver Configuration:

The IOCOMx transceiver controls momentary switches by default. The control may be configured to respond in different manners, one pair/group at the time. The grouping is maintained in pairs, for instance group one is Input one and Input two -- with: Relay one and Relay two.

Receiver Logic Selection list:

The following modes are available:

Momentary	Toggle	Interlock
Pri. Interlock	1on / 1off	2on / 2off
Delayed Timed-Off	Delayed Hold Timed-Off	Delayed Time-On
Delayed Hold Timed-On	Disabled	

Modes Description

a.) Momentary:

When a Button is pressed, the corresponding Relay is closed, when the Button is released, the Relay opens.

b.) Toggle:

When a Button is pressed the Relay closes, when a Button is pressed again, Relay opens. c.) Interlock: Only one of the group outputs are active at any one time; if both Inputs are present, no output is on.

d.) Pri. Interlock: (Priority interlock)

Only one of the group outputs are active at any one time, if a second Input becomes active, the output which is already active has priority and stays on.

e.) 1on1off:

Button 1 of the group turns the Relay on, Button 2 of the group turns the Relay off.

f.) 2on2off:

Button one and two pressed together turns on Relay 1 and Relay 2; Button one and two pressed together again turns the Relay off.

g.) On Timed Off:

The Buttons turn the corresponding Relay on, and after a set amount of time, the Relay automatically turns off. The delay time can be specified below, individually on a per Input basis.

h.) On Hold Timed Off:

The Button turns the corresponding Relay on, and on Button release, the hold timer starts, which holds the Relay for a specified amount of time. after which, the Relay automatically turns off.

i.) Timed ON:

When a button is pressed, a timer starts. When the timer is expired, the corresponding Relay will close.

j.) Hold Timed On:

Button is pressed, and then, when released a timer starts. After the timer is expired, the corresponding Relay will close.

k.) Disabled:

The corresponding group's Relays will not activate;

Timed-Off / Timed-On Timings:

If the IOCOMx transceiver group is set to TimedOff mode, these are the corresponding timing values on a per output basis. Time is specified in seconds; for example the value 90 will specify one an a half minutes. The smallest delay is one second, there is no limit placed on the largest delay. Following, is the default timeout setting:

Outputs 1 and 2:

Timeout 1: sec

Timeout 2: sec

Outputs 3 and 4:

Timeout 3: sec Timeout 4: sec

Timed-Off Timed-ON retrigger:

If a group is set to 'Delayed Timed On' or 'Delayed Timed Off' mode, the individual Inputs can be configured to re-trigger. This way the timing of the timer can be extended during the hold interval. When the Output's box is checked, the timing delay of the Output is expanded like a new timer cycle is started. The re-Trigger mode defaults to OFF, the timer is unaffected by successive button presses.

Outputs 1 and 2:

Enable Re-trigger 1: Enable Re-trigger 2:

Outputs 3 and 4:

Enable Re-trigger 3: Enable Re-trigger 4:

Web page footers

The web page footers contain useful information about the device itself. The MAC address acts as a globally unique identifier. The Software version / Build date identifies the firmware used in this device. The footer also contains

CAN Controls

The IOCOMx system relies on the built-in CAN bus to connect multiple IOCOMx devices to send/receive data for all 64 channels. The CAN will detect mis-configuration and alerts the user if:

- No IOCOMx module is marked as TxRx unit
- More than one module is marked as TxRx unit on the same bus
- More than one IOCOMx module occupies the same ordinal

The CAN LED stays ON solid if the CAN bus detects any of these errors, additionally the error condition is shown on the configuration web page, as well as a command is issued on the controlling terminal.

CAN IDS:

These IDS represent the IOCOM's CAN interaction between boards and to the outside world.

```
#define MSG_SWITCHES    0x19EE5501 // Intra IOCOMx msg to funnel to RF
#define MSG_TID         0x19EE5502 // Intra IOCOMx msg / presence check
#define MSG_MASKS       0x19EE5503 // Intra IOCOMx msg mask
#define MSG_RELAYS      0x19EE5504 // Control local relays
#define MSG_BRIDGE      0x19EE5505 // Control remote relays (note: timeout)
#define MSG_INPUTS      0x19EE5506 // The status of the inputs
#define MSG_OUTPUTS     0x19EE5507 // The status of the outputs
#define MSG_MASKAUX     0x19EE5508 // IOCOM auxiliary mask
#define MSG_AUX         0x19EE5509 // IOCOM auxiliary command
#define MSG_RESERVED    0x19EE550a // IOCOM reserved for future use
```

(text pasted from source to avoid documentation process errors)

Reading / Writing to the CAN bus

The IOCOMx attempts to be a standard compilant

Reading Switch information from the CAN bus

Controlling local relays from the CAN bus

The IOCOM's CAN interface can receive instructions from the CAN bus.

Use: robotell.py [options] data1 .. dataN

Where options can be:

```
-V      --version  print version
-h      --help    print help
-c      --devices  print supported devices
```

-t --timing show timing
-i --interface interface board (def: robotell)
-l --listen listen
-g --bridge bridge
-v --verbose verbose
-p port --port serial port (def: /dev/ttyUSB0)
-b bitrate --bitrate bit rate (def: 250000)
-i message --message message id (def=0x19EE5504)
-m mask --mask effective bit mask
-u value --value value to send to device
-o ord --ord ordinal to send to
-d level --debug debug level

Arguments for short options also needed for the long options.

Controlling remote IOCOMx from the CAN bus