Introduction

The Remote Input/Output Modules extend the Input and output capabilities of Comfort. Each IR Switch Module has 8 Input/ and Output points. Up to 8 RIO Modules can be connected to a Comfort system with “Outside” or “Ultra” firmware, providing a further 64 non-alarm inputs and 64 outputs.

RIO Input functions;

- receives Comfort IR codes (with the same function as the KP02 IR receiver) from the Philips Pronto, to trigger Comfort Responses. Infrared Receiver modules (IRR01) must be connected to the input to receive IR signals.
- receives X10 IR codes from the X10 UR24 RF/IR Remote control or Philips Pronto to activate X10 codes directly.
- accepts a switch contact (or digital 5V logic level signal) to trigger Responses when the contact is opened and/or closed.

RIO Output functions;

- Provides digital 12V/0V output
- Drives LEDs (with a series resistor) for indication purposes.
- Transmits Infrared remote (IR) control signals by connecting an Infrared LED transmitter (IRM01, IR01W, IR02W)
- Drives 8 reed relays on the RLY02 module to provide dry contacts for external triggering.

The combination of inputs and outputs can be used as Scene Switches, providing status indication via the RIO outputs.

These inputs and outputs are not part of the 64 Inputs and 64 Outputs of the Comfort Control panel, LEMs and SEMs. They are numbered as input/output 129 to 192.

☎ **RIO Inputs cannot be used as Alarm Inputs. They have no alarm function, and are used to activate Responses via switch contacts or infrared signals.**

The IRD01 IR Dome is a combination IR Receiver and Transmitter which can be mounted on the ceiling to be used with the RIO.

The IRD01 transmits IR signals through 8 infrared LEDs, as well as receives Comfort IR signals send from a handheld remote control like the RC01 and Philips Pronto. The IRD01 is connected to the RIO, replacing IRR01 IR receivers and IRW01 IR transmitters.

Applications of RIO

- Scene Switches with buttons and LED indicators
- Infrared Transmitters can be connected to RIO outputs
- Infrared receivers (IRR01) can be connected to RIO inputs to activate any Comfort response from handheld remote control, e.g. Philips Pronto, or the UR24 X10 remote control for sending X10 commands
- The IRD01 IR Dome can be connected to RIO input and output to send and receive IR signals.
- Mimic Panel LED drivers.
- Two way switch input/outputs (used with TWS01/02 Lighting Modules)

RIO Specifications

Printed Circuit Board Dimensions: 108 x 88 mm

Current consumption: 12V @ 25 mA max, 15 mA typical with all outputs off.

Power Supply: 12V @ 500 mA if full output current of 500mA for 8 channels is to be used.

Inputs:

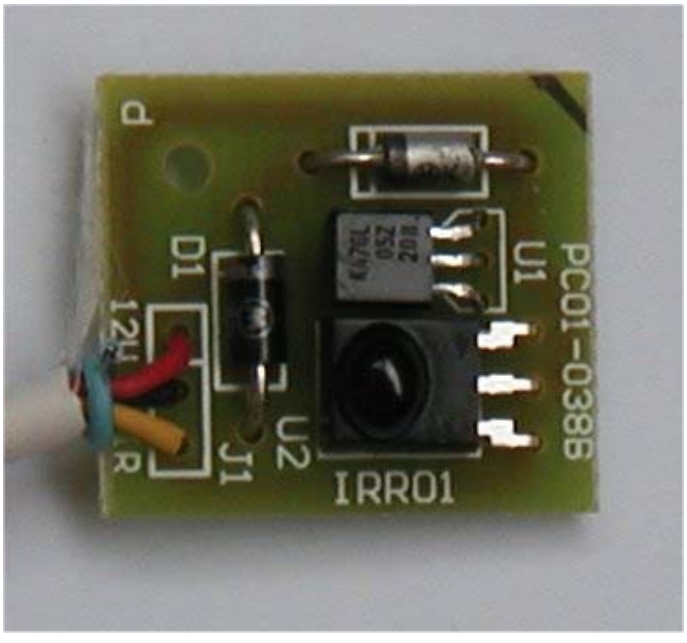
Logic ‘0’ : 1.0 V Max

Logic ‘1’ : 2.0 V Min

Input overvoltage protection up to 25V continuous.

All Inputs have internal pull-up resistance of 100 K.

Infrared Receiver (IRR01)



Each Input on the RIO can be connected to an Infrared Receiver (IRR01) to receive Comfort Infrared Codes or X10 IR codes (from the X10 IR/RF handheld remote control UR24). The IRR01 IR receiver is connected by 3 wires to the RIO; 12V, Ground, and IR. The IRR01 can be located up to 100 meters from the RIO. Twisted Shielded cable is recommended. No programming is required to configure the RIO Input

as an Infrared receiver. The RIO automatically detects if the incoming signal is a valid IR signal in Comfort or X10 format, or an open/close switch.

The IR codes which can be recognised are:

Comfort IR codes: 0 to 127. These are the same codes recognised by the KP02.

UR24 X10 IR signals: Housecodes A to P, unit Codes 1 to 16.

Outputs:

Logic '1': 12V nominal

Logic '0': 1.8V max

Outputs are open-collector which pull down to ground when active with common 12V on the centre pin of the 3-pin terminal block. This is the same configuration as Comfort Control Panel, SEM and LEM01.

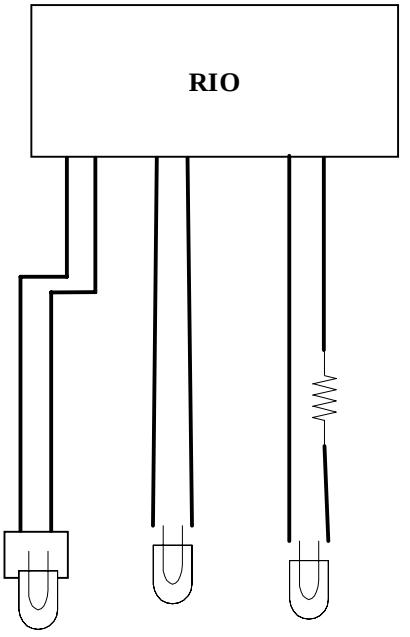
Sink Current: 100 mA max per output, 300 mA combined.

Pulse current: 350 mA from each output.

Overcurrent protection: 300 mA from all combined causes shutdown of the resettable fuse and shuts down the output.

Output Breakdown Voltage: 35 V minimum.

Internal reverse clamp diodes to ground at each output to protect against output transients when driving inductive loads e.g. Relays.



Connection of Infrared and Visible LEDs to RIO Outputs

The figure above shows the connection of visible light and infrared transmitter LEDs to RIO outputs. The IRM01 Infrared Transmitter Modules are used as an IR "blaster" with a range of up to 8 meters and with series Resettable fuse protection. IRW01 and IRW02 are infrared Transmitter LEDs with built-in resistor and cable assembly which are for short range, up to 1 meter. They have a larger series resistance and do not need Resettable fuses. IRW01 has a round IR transmitter LED and IRW02 has a flat IR transmitter LED. Note that polarity of connection to infrared transmitters. The Positive terminal of the IR transmitter must be connected to 12V and negative of the IR transmitter to the Output terminal of the RIO.

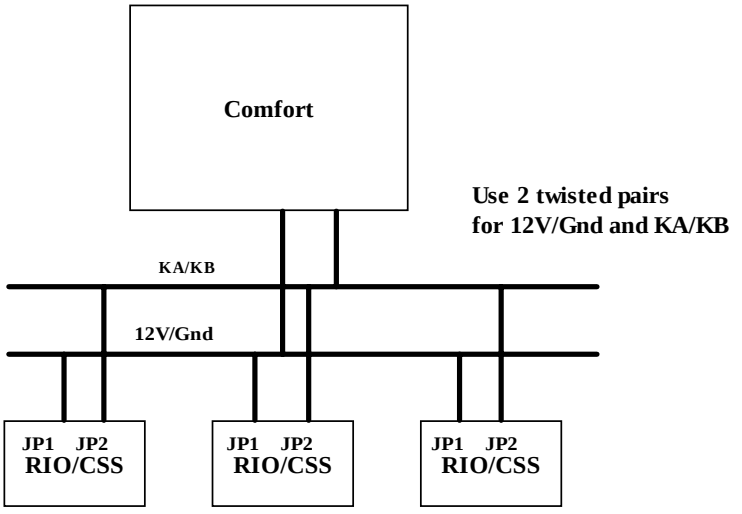
Infrared Transmission

Each output is capable sending Infrared signals from Comfort's IR signal library. IR transmitter LEDs (IRM01, IRW01/02) should be connected to the output.

System Requirements

- Comfort Control Panel with firmware "Outside 4.160" or higher version.

Settings



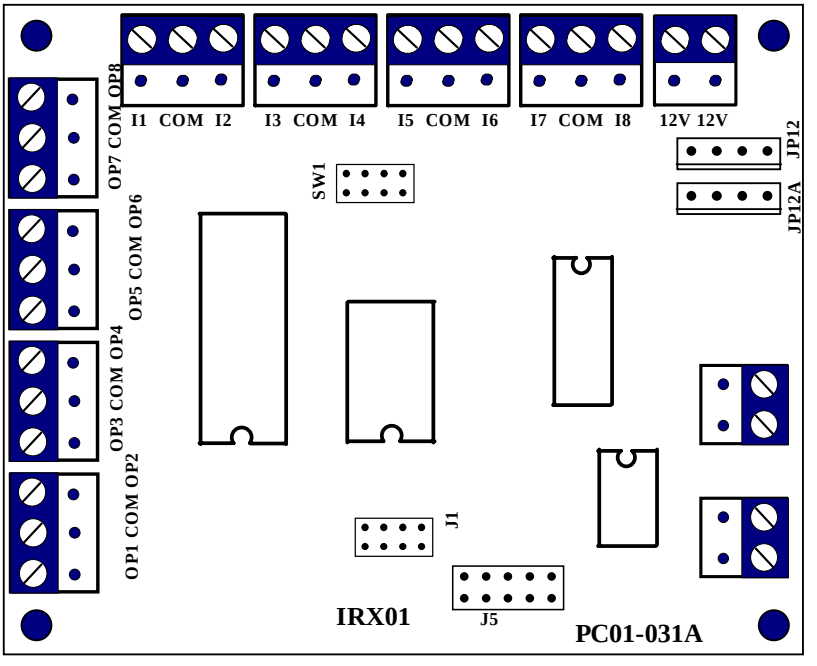
Connections between RIO and Comfort

The RIO modules are connected to the Comfort panel by 4 wires, 12V/COM, for power supply, and KA/KB for RS485 data.

Connections

- JP1: 12V/COM terminal block for Supply Voltage from Comfort.
- JP2: KA/KB terminal block for RS485 data, in parallel to KA/KB on JP12/JP12A. KA/KB is connected to KA/KB on Comfort. Twisted pair wire should be run to Comfort for KA/KB.
- JP12: 4 way header (12V/Com/KA/KB). This is connected to Comfort J15 connector via the supplied cable. This connection to Comfort is used instead of JP1 and JP2 when the distance is within 3 meters, i.e. when the RIO module is mounted right next to Comfort. It cannot be used for longer distances, as the KA/KB wires are not twisted.
- JP12A: Auxiliary 4 way header (12V/Com/KA/KB). This can be connected to other RIOs or UCM. The signals on JP12A are identical (in parallel) to those on JP12.
- JP3 - JP6: Outputs 1 to 8. Each 3-pin terminal block has 2 adjacent outputs with a center common 12V.
- JP7 - JP10: Inputs 1 to 8. Each 3-pin terminal block has 2 adjacent Inputs with a center common ground
- JP13: For connection of 5V buzzer, in parallel with D1 LED

- JP11: 2 way 12V terminal block
- J5: 2 x 5 connector, can be connected to 8 way reed relay module RRM01



RIO PCB

Buttons

- SW1 - Fault RESET. This resets the Output drivers after a Fault condition has occurred, as shown by the D5 Fault LED.

LED Indicators

- D1 (Red). The LED is normally off. It will blink once when one of its inputs change state, or a valid IR code is received by one of its inputs, an IR code is transmitter from one of its outputs, and after reset. The LED will flash continuously when communication with Comfort is lost for 20 seconds.
- D5 (Fault). Not used

ICs

- U1 - Microcontroller IC

- U3 - RS485 Interface
- U4 - Output Driver

Jumper Settings

ID Switch (J1)

The Comfort "Outside" version is able to support up to 8 RIO. J1 is a set of 4 headers which determines the UCM ID, according to the table below:

ID	J1- A	J1 - B	J1 - C	J1 - D
1	Short	Short	Short	Short
2	Open	Short	Short	Short
3	Short	Open	Short	Short
4	Open	Open	Short	Short
5	Short	Short	Open	Short
6	Open	Short	Open	Short
7	Short	Open	Open	Short
8	Open	Open	Open	Short
9	Short	Short	Short	Open
10	Open	Short	Short	Open
11	Short	Open	Short	Open
12	Open	Open	Short	Open
13	Short	Short	Open	Open
14	Open	Short	Open	Open
15	Short	Open	Open	Open

Table 1 - RIO ID Switch Settings

The table shows settings for 15 RIO Ids, although the Comfort "Outside" version is only able to support 8 Ids. Future Comfort versions with a larger program memory in U4 shall be able to support 15 RIOs.

☎ **The Scene Control Switches (SCS) share the same ID space with the RIO modules. Do not set any RIO and SCS with the same ID, as this will cause a conflict and lead to a "communications failure" trouble alarm.**

☎ **After changing the ID settings, remove and reapply power through the 12V/COM terminal block or JP12.**

Function Selector (J2)

4 shunts on J2 marked P,Q,R,S determine the following function settings:

J2-P

Closed: Each input will report ON and OFF codes to Comfort when it is closed and opened respectively. This setting is for two position switches (rather than momentary switches)

Open: Each switch will report the ON transition when the switch input is closed, but not the OFF transition when the switch is opened. This is for momentary switches. However, if adjacent input pairs (1 and 2, 3 and 4 etc.) turn on at the same time, the On transition is not reported.

J2-Q

Closed: Outputs will not blink when a valid IR signal (Comfort or X10 code) is received at the corresponding input

Open: The Outputs will blink once when a valid IR signal (Comfort or X10 code) is received at the corresponding input. This is used for an indicator LED in conjunction with the corresponding IR receiver input.

J2-R

Closed: The Outputs will not flash continuously when the corresponding Input changes state.

Open: The Outputs will flash continuously when the corresponding Input changes state, until a new output command is sent to the affected output.

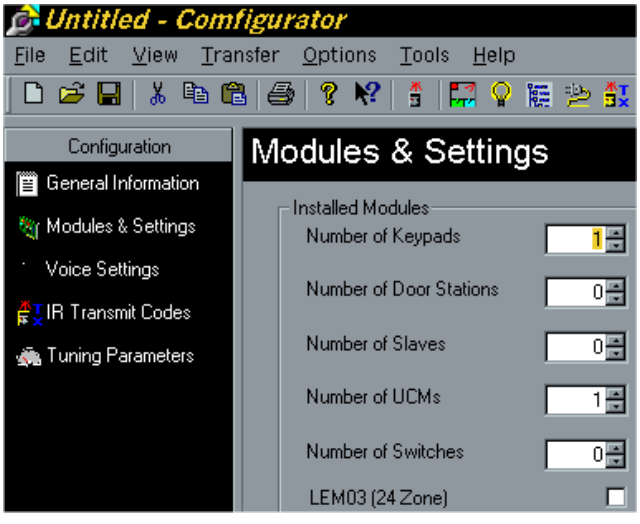
J2-S

Not in use, should be closed.

Programming the RIO

Number of SCS/RIO

The number of Scene Control Switches (SCS) and Remote Input/Outputs (RIO) connected to the system must be programmed into Comfort. This can be done in Comfigurator in Configuration > Modules & Settings as shown below



Number of SCS/RIO (Number of Switches in earlier versions) sets the number of SCS and RIO connected to Comfort.

To program this using the keypad/phone voice menu, set Location 1676 to the number of SCS/RIOs connected. Press RESET on Comfort after doing this.

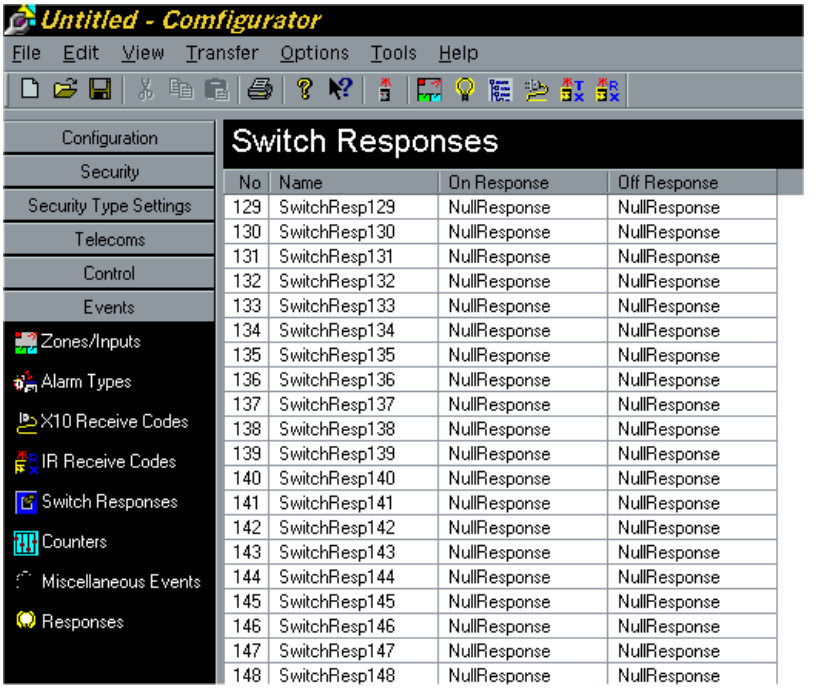
If any RIO Module loses communications with Comfort, it will be reported as "Communications Failure *ID#*" where *ID#* is 81 for RIO ID 1, 82 for ID 2, 83 for ID 3 and so on.

When the RIO module loses communications with Comfort, the onboard D1 red led will flash continuously until communications is restored. The D1 LED will not flash if it is able to receive data via KA/KB (RS485) even if its ID is not polled due to incorrect settings for Location 1676.

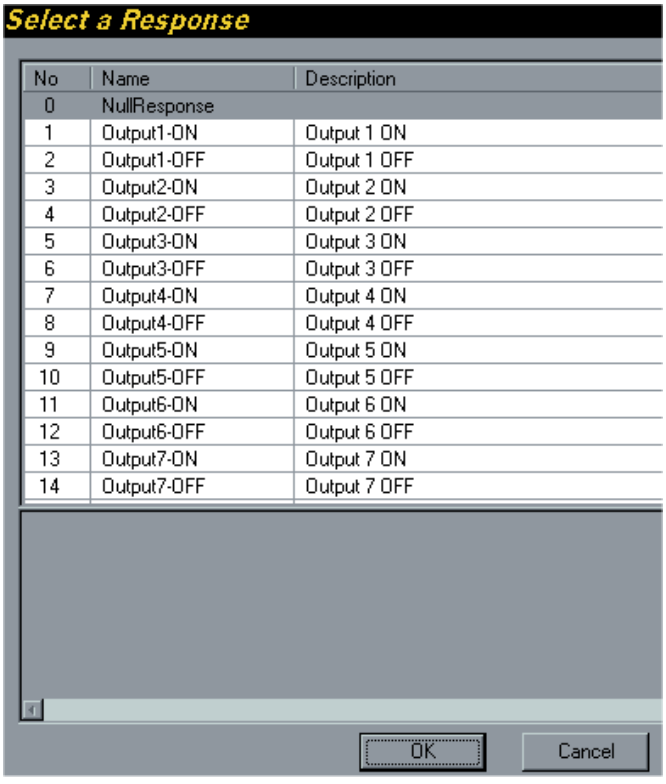
Inputs

Each Input can accept a normally open switch contact, or a digital 5V/0V input. Closing and opening the switch on an input causes Responses in Comfort to be activated. The inputs can be programmed to turn on individual lights or appliances, or to activate Scenes (combination of behaviours). The corresponding outputs can be connected to an LEDs as indication of the scene or appliance status.

When each Input changes its state, it will activate a programmed Response depending on the RIO Module ID (1 to 15) and its number (1 to 8), and whether it is ON (0V) or OFF (5V). This can be programmed in Comfigurator by selecting Events > SCS/RIO Responses (called "Switch Responses" in some versions). Each RIO has 8 inputs. RIO ID=1 has Input 129 to 136, ID=2 has Input 137 to 144, and so on. Each Input has a corresponding ON Response and OFF Response just like Comfort's regular Inputs. A Name (2nd column of table below) can be assigned to each Input to identify it.



To select a Response from the OnResponse or OfResponse column, right-click on the entry to open a Select Response Window



Select a Response from the list and click OK. To sort the responses by Number, Name or Description, click on the respective titles of the columns.

If J2-P shunt is Open, i.e. only switch ON is reported, the OFF Response ha no effect. If J2-P shunt is closed, both ON and OFF Responses will be valid.

To program the Switch (SCS/RIO) Responses using the keypad or telephone voice menu, the Location for each RIO ID switch on and off response is shown in the tables below (applicable to Comfort PRO File System 18).

RIO ID	**1**				
Input	**System Input**	**Switch Code Response Location**			
		ON - Closed (0V)		**OFF - Open (5V)**	
1	129	6,276		6,277	
2	130	6,278		6,279	
3	131	6,280		6,281	
4	132	6,282		6,283	
5	133	6,284		6,285	
6	134	6,286		6,287	
7	135	6,288		6,289	
8	136	6,290		6,291	

RIO ID	**2**				
Input	**System Input**	**Switch Code Response Location**			
		ON - Closed (0V)		**OFF - Open (5V)**	
1	137	6,292		6,293	
2	138	6,294		6,295	
3	139	6,296		6,297	
4	140	6,298		6,299	
5	141	6,300		6,301	
6	142	6,302		6,303	
7	143	6,304		6,305	
8	144	6,306		6,307	

RIO ID	**3**				
Input	**System Input**	**Switch Code Response Location**			
		ON - Closed (0V)		**OFF - Open (5V)**	
1	145	6,308		6,309	
2	146	6,310		6,311	
3	147	6,312		6,313	
4	148	6,314		6,315	
5	149	6,316		6,317	
6	150	6,318		6,319	
7	151	6,320		6,321	
8	152	6,322		6,323	

RIO ID	**4**				
Input	**System Input**	**Switch Code Response Location**			
		ON - Closed (0V)		**OFF - Open (5V)**	
1	153	6,324		6,325	
2	154	6,326		6,327	
3	155	6,328		6,329	
4	156	6,330		6,331	
5	157	6,332		6,333	
6	158	6,334		6,335	
7	159	6,336		6,337	
8	160	6,338		6,339	

RIO ID	**5**	

Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	161	6,340		6,341	
2	162	6,342		6,343	
3	163	6,344		6,345	
4	164	6,346		6,347	
5	165	6,348		6,349	
6	166	6,350		6,351	
7	167	6,352		6,353	
8	168	6,354		6,355	

RIO ID	6				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	169	6,356		6,357	
2	170	6,358		6,359	
3	171	6,360		6,361	
4	172	6,362		6,363	
5	173	6,364		6,365	
6	174	6,366		6,367	
7	175	6,368		6,369	
8	176	6,370		6,371	

RIO ID	7				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	177	6,372		6,373	
2	178	6,374		6,375	
3	179	6,376		6,377	
4	180	6,378		6,379	
5	181	6,380		6,381	
6	182	6,382		6,383	
7	183	6,384		6,385	
8	184	6,386		6,387	

RIO ID	8				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	185	6,388		6,389	
2	186	6,390		6,391	
3	187	6,392		6,393	
4	188	6,394		6,395	
5	189	6,396		6,397	
6	190	6,398		6,399	
7	191	6,400		6,401	
8	192	6,402		6,403	

Table 2A - RIO Response Locations for RIO ID Inputs (FS18)

Locations for RIO Responses for File System 24 and 34.

☎ **Each Response takes two locations.**

RIO ID	1				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	129	4,480		4,482	
2	130	4,484		4,486	
3	131	4,488		4,490	
4	132	4,492		4,494	
5	133	4,496		4,498	
6	134	4,500		4,502	
7	135	4,504		4,506	
8	136	4,508		4,510	

RIO ID	2				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	137	4,512		4,514	
2	138	4,516		4,518	
3	139	4,520		4,522	
4	140	4,524		4,526	
5	141	4,528		4,530	
6	142	4,532		4,534	
7	143	4,536		4,538	
8	144	4,540		4,542	

RIO ID	3				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	145	4,544		4,546	
2	146	4,548		4,550	
3	147	4,552		4,554	
4	148	4,556		4,558	
5	149	4,560		4,562	
6	150	4,564		4,566	
7	151	4,568		4,570	
8	152	4,572		4,574	

RIO ID	4				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	153	4,576		4,578	
2	154	4,580		4,582	
3	155	4,584		4,586	
4	156	4,588		4,590	
5	157	4,592		4,594	
6	158	4,596		4,598	
7	159	4,600		4,602	
8	160	4,604		4,606	

RIO ID	5				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	161	4,608		4,610	
2	162	4,612		4,614	
3	163	4,616		4,618	
4	164	4,620		4,622	
5	165	4,624		4,626	
6	166	4,628		4,630	
7	167	4,632		4,634	
8	168	4,636		4,638	

RIO ID	6				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	169	4,640		4,642	
2	170	4,644		4,646	
3	171	4,648		4,650	
4	172	4,652		4,654	
5	173	4,656		4,658	
6	174	4,660		4,662	
7	175	4,664		4,666	
8	176	4,668		4,670	

RIO ID	7				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	177	4,672		4,674	
2	178	4,676		4,678	
3	179	4,680		4,682	
4	180	4,684		4,686	
5	181	4,688		4,690	
6	182	4,692		4,694	
7	183	4,696		4,698	
8	184	4,700		4,702	

RIO ID	8				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	185	4,704		4,706	
2	186	4,708		4,710	
3	187	4,712		4,714	
4	188	4,716		4,718	
5	189	4,720		4,722	
6	190	4,724		4,726	
7	191	4,728		4,730	
8	192	4,732		4,734	

RIO ID	9				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	193	4,736		4,738	
2	194	4,740		4,742	
3	195	4,744		4,746	
4	196	4,748		4,750	
5	197	4,752		4,754	
6	198	4,756		4,758	
7	199	4,760		4,762	
8	200	4,764		4,766	

RIO ID	10				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	201	4,768		4,770	
2	202	4,772		4,774	
3	203	4,776		4,778	
4	204	4,780		4,782	
5	205	4,784		4,786	
6	206	4,788		4,790	
7	207	4,792		4,794	
8	208	4,796		4,798	

RIO ID	11				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	209	4,800		4,802	
2	210	4,804		4,806	
3	211	4,808		4,810	
4	212	4,812		4,814	
5	213	4,816		4,818	
6	214	4,820		4,822	
7	215	4,824		4,826	
8	216	4,828		4,830	

RIO ID	12				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	217	4,832		4,834	
2	218	4,836		4,838	
3	219	4,840		4,842	
4	220	4,844		4,846	
5	221	4,848		4,850	
6	222	4,852		4,854	
7	223	4,856		4,858	
8	224	4,860		4,862	

RIO ID	13				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	225	4,864		4,866	
2	226	4,868		4,870	
3	227	4,872		4,874	
4	228	4,876		4,878	
5	229	4,880		4,882	
6	230	4,884		4,886	
7	231	4,888		4,890	
8	232	4,892		4,894	

RIO ID	14				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	233	4,896		4,898	
2	234	4,900		4,902	
3	235	4,904		4,906	
4	236	4,908		4,910	
5	237	4,912		4,914	
6	238	4,916		4,918	
7	239	4,920		4,922	
8	240	4,924		4,926	

RIO ID	15				
Input	System Input	Switch Code Response Location			
		ON - Closed (0V)		OFF - Open (5V)	
1	241	4,928		4,930	
2	242	4,932		4,934	
3	243	4,936		4,938	
4	244	4,940		4,942	
5	245	4,944		4,946	
6	246	4,948		4,950	
7	247	4,952		4,954	
8	248	4,956		4,958	

Table 2B - RIO Response Locations for RIO ID Inputs (FS24/34)

☎ **Only 8 RIO/SCS are supported in File System 24 (Comfort I Ultra) and File Systenm 34 (Comfort II Ultra), currently even though Locations for RIO 9 to 15 are present. Future firmware may implement 15 RIO/SCS**

For File System 24 and 34, each Response takes up 2 consecutive locations.

For Response R = 0 to 1024

Divide R by 256 to get the value in the higher location.

The Remainder is in the lower location

Eg RIO ID 15 Input 1 ON enter Response 500

500/256 = 1 Remainder 244

In Location 4928 enter 244, Location 4929 enter 1

Use Comfigurator to program RIO Responses for Comfort Ultra, as Ultra Responses require 2 locations for each Response which makes it more complicated to program using Locations

☎ **Even though the RIO Module addressing capability is 15, File System 18 only has enough memory locations to support 8 RIO IDs.**

For example of ID = 3, input 5 Closed will activate the Response in Location 6316. When the switch Opens. The Response in Location 6317 is activated

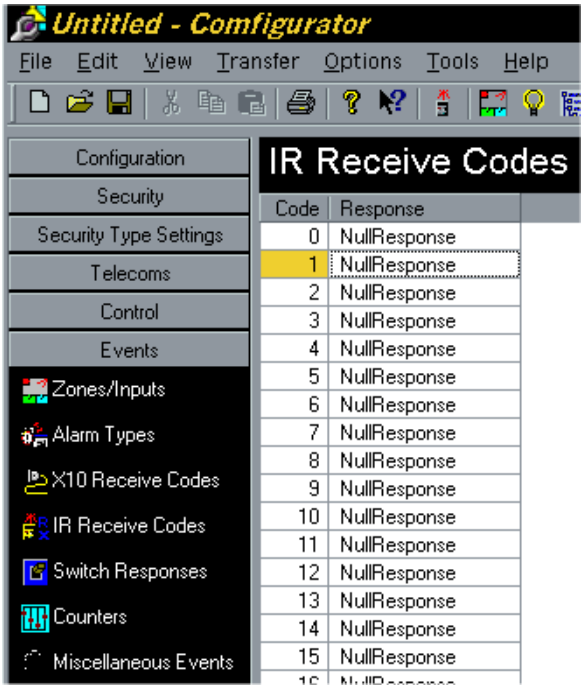
☎ **The Locations menu is Accessed via Engineer menu 7,4,1**

Alternately, the Comfigurator software can be used to assign responses for each RIO Input without having to find out about Location numbers.

☎ **RIO Inputs are NOT alarm inputs; they are meant for receiving switch contacts or IR signals and triggering Responses. Only Slave (SEM) and Local Expansion Modules (LEM) or Comfort Main panel Inputs can act as alarm inputs.**

Received Infrared Codes

The RIO, as in the KP02 IR keypad will recognise a set of 128 Comfort IR codes, numbered 0 to 127. Each of these IR codes can trigger a response to be activated. To select the Responses to be activated by each IR code in Comfigurator, select Events > IR Receive Codes as shown in the screenshot below;


Untitled - Comfigurator
File Edit View Transfer Options Tools Help
Configuration
Security
Security Type Settings
Telecoms
Control
Events
Zones/Inputs
Alarm Types
X10 Receive Codes
IR Receive Codes
Switch Responses
Counters
Miscellaneous Events
IR Receive Codes
Code Response
0 NullResponse
1 NullResponse
2 NullResponse
3 NullResponse
4 NullResponse
5 NullResponse
6 NullResponse
7 NullResponse
8 NullResponse
9 NullResponse
10 NullResponse
11 NullResponse
12 NullResponse
13 NullResponse
14 NullResponse
15 NullResponse

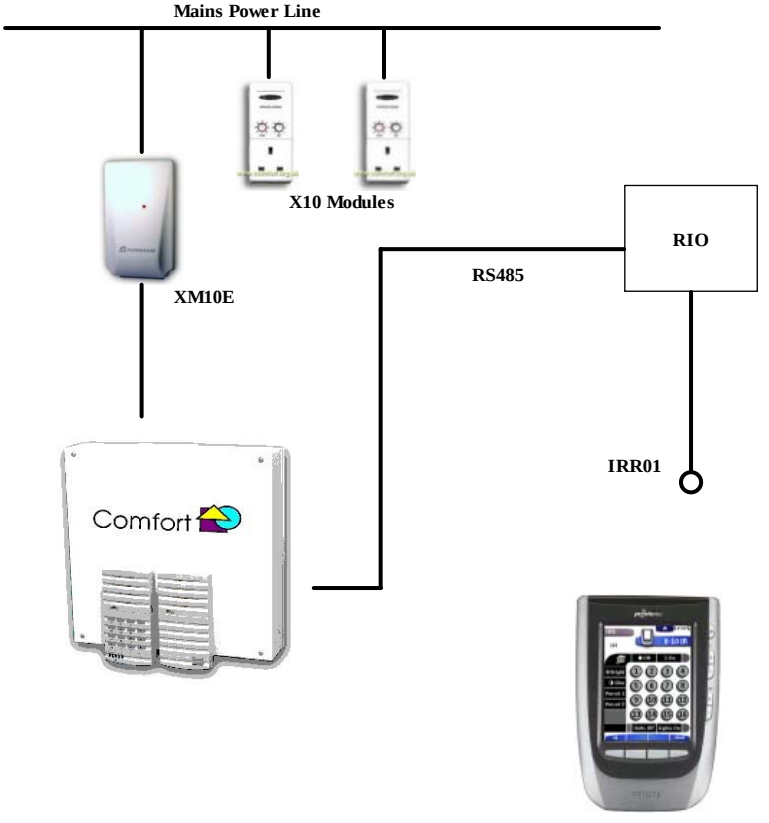
For keypad/phone voice menu programming, the table of Locations for IR received Responses is as follows;

IR No	Location	Resp	IR No	Location	Resp	IR No	Location	Resp	IR No	Location	Resp
0	6,148		32	6,180		64	6,212		96	6,244	
1	6,149		33	6,181		65	6,213		97	6,245	
2	6,150		34	6,182		66	6,214		98	6,246	
3	6,151		35	6,183		67	6,215		99	6,247	
4	6,152		36	6,184		68	6,216		100	6,248	
5	6,153		37	6,185		69	6,217		101	6,249	
6	6,154		38	6,186		70	6,218		102	6,250	
7	6,155		39	6,187		71	6,219		103	6,251	
8	6,156		40	6,188		72	6,220		104	6,252	
9	6,157		41	6,189		73	6,221		105	6,253	
10	6,158		42	6,190		74	6,222		106	6,254	
11	6,159		43	6,191		75	6,223		107	6,255	
12	6,160		44	6,192		76	6,224		108	6,256	
13	6,161		45	6,193		77	6,225		109	6,257	
14	6,162		46	6,194		78	6,226		110	6,258	
15	6,163		47	6,195		79	6,227		111	6,259	
16	6,164		48	6,196		80	6,228		112	6,260	
17	6,165		49	6,197		81	6,229		113	6,261	
18	6,166		50	6,198		82	6,230		114	6,262	
19	6,167		51	6,199		83	6,231		115	6,263	
20	6,168		52	6,200		84	6,232		116	6,264	
21	6,169		53	6,201		85	6,233		117	6,265	
22	6,170		54	6,202		86	6,234		118	6,266	
23	6,171		55	6,203		87	6,235		119	6,267	
24	6,172		56	6,204		88	6,236		120	6,268	
25	6,173		57	6,205		89	6,237		121	6,269	
26	6,174		58	6,206		90	6,238		122	6,270	
27	6,175		59	6,207		91	6,239		123	6,271	
28	6,176		60	6,208		92	6,240		124	6,272	
29	6,177		61	6,209		93	6,241		125	6,273	
30	6,178		62	6,210		94	6,242		126	6,274	
31	6,179		63	6,211		95	6,243		127	6,275	

Table 3 - IR Received Response Locations (FS18)

X10 IR Codes

Each RIO Input can also receive IR Codes from the X10 RF/IR remote control UR24 or from a Philips Pronto programmed with the X10 Ircodes. The RIO can recognise X10 IR codes for all 16 housecodes, and will transmit the X10 signals onto the Powerline through the XM10E or TW7223 X10 Power Line Interface (Not Supplied). No programming is required. Comfort simply transmits the X10 commands to the Power Line.



Receiving Comfort and X10 IR Codes

Outputs

RIO Input/output Numbering and Actions

RIO Inputs and Outputs share the same numbering system as Comfort's regular inputs and outputs from the Main panel, LEMs and SEMs, but they start from output 129, while Comfort regular inputs and outputs range from 1 to 64, The table below shows RIO Input and Output numbering:

RIO ID	Input/Output No
1	129 to 136
2	137 to 144
3	145 to 152
4	153 to 160
5	161 to 168
6	169 to 176
7	177 to 184
8	185 to 192
9	193 to 200
10	201 to 208
11	209 to 216
12	217 to 224
13	225 to 232
14	233 to 240
15	241 to 248

Table 4 - RIO Input/Output Numbering System

This allows the same Output actions used to control regular outputs (on Comfort, LEMs and SEMs) to be also applicable to RIO outputs, for example;

Action 128, output #, parameter

Parameter can be 0 for OFF, 1 for ON, 2 for Invert state, 3 for Pulse output 1 second, 4 for Flash output at 1 second on/off rate.

Example,

128,135,2 RIO ID 1 Output 7 Change State

128,157,3 RIO ID 4 Output 5 Pulse 1 second

128,181,4 RIO ID 7 Output 5 Flash at 1 second rate

Action 78, output#

This action also changes the state of the specified output similar to 128,output#, 2. Both actions can be used, but action 78 requires one less parameter.

Action 129, irno, output#

This action sends an IR code to the specified output

Example:

129,20,177	IR No 20 to RIO ID 7, output 1
129, 45, 171	IR No 45 to RIO ID 6, output 3

Action 130, duration50ms, output#

This action pulses an output for the specified duration in 50 ms units, but **it does not work for RIO Module Outputs**. It can only be applied to regular Comfort outputs on the main panel, LEM01 or SEM.

Action 77, output#

This action checks the state of the specified output. It will return 0 for OFF and 1 for ON

Example:

77, 138	Check state of RIO ID 2, output 2, return 0 for OFF, 1 for ON

RIO Inputs numbered 129 onwards do not activate Alarms like Comfort's regular Inputs (on Main Panel, LEMs and SEMs), but they can be interrogated like regular Inputs using Action codes.

Action 79, Input#

This actions returns the state of the Input, i.e.. 0 for off, 1 for On

Example:

79, 130	Return state of RIO ID 1 Input 2
13	Skip if NZ (i.e.. Skip if Input is On)
78,130	Change state of RIO ID 1 Output 2
255	Terminator

The above example is the code for two way switch control of a light.

Action 1 - Announce Zone Name

This action is not applicable to RIO Inputs, it will not cause the RIO Input name to be announced. In any case, the RIO Input cannot be assigned to words like a regular Input

Action 89, Input#

This action returns the analog value of Comfort Inputs, but **it does not apply to RIO inputs**, which are strictly digital inputs.

UCM RS232 Commands

UCM RS232 commands can be used to control and monitor the RIO Inputs and Outputs just like Comfort's regular inputs and outputs.

O! - Output Activation Command

PC:	O!*nnss*
UCM:	OK

nn is the output number 81 to C0 (Hex) for RIO outputs 129 to 192

ss is the output status 00=off, 01=on, 02=change state , 03 = Pulse Output for 1 second, 04 - Flash Output at 1 sec On/Off rate

OP - Output activation Report

UCM: OP*nnss*
UCM sends the OP report when the RIO outputs turn on or off

O? - Output status request

PC: O?*nn*
UCM: O?*nnss*
nn is the output number 81H to C0H for RIO Outputs
ss is the output status 00=off, 01=on

P! - Pulsed Output Command

PC: P!*nnpp*
UCM: OK
nn is the output number 81-C0H for RIO Outputs
pp is the pulse width 0 to 0FFH in 50 ms units

If the output is in the Comfort main panel, not slave, the UCM sends the PT Report in the same format when the command is carried out

UCM: PT*nnpp*

If the output is on a slave or RIO, the UCM does not send the PT command, it sends Output reports when the output is turned on and off

UCM: OP*nn*01
UCM: OP*nn*00

I? - Input Status Report/Request

PC: I?*nn*
UCM: I?*nnss*
nn is the input number 81-C0H for RIO Inputs
ss is the status 00 = Off, 01 = ON

IP - Input activation report

UCM: IP*nnss*
nn is the input number 81-C0H for RIO Inputs
ss is the state 0 = Off, 1 = ON
UCM sends the message when an input is activated or restored

IR - IR Activation Command/Report

PC: I*Rnnrr*
UCM: OK
UCM: IR*nnrr*
nn is the output number 81-C0H for RIO Outputs
rr is the IR number 01 to the maximum IR number. If IR number 00 is reported, it means that the IR code is undefined or has an error.

UCM sends the IR report when an IR code is activated by master or slave. If the IR is not activated, there is no report

IX - IR Code Received

UCM: IXnn

IX reports an IR code received by Comfort through a keypad or IR receiver. NN is the code number 00 to 7F

Cold Start/Warm Start Behaviour

A **Cold Start** is defined as operation of RIO when Power is first applied, or reapplied after a complete power off. A **Warm Start** is defined as operation when a reset command is sent from Comfort or the RESET button is pressed on Comfort.

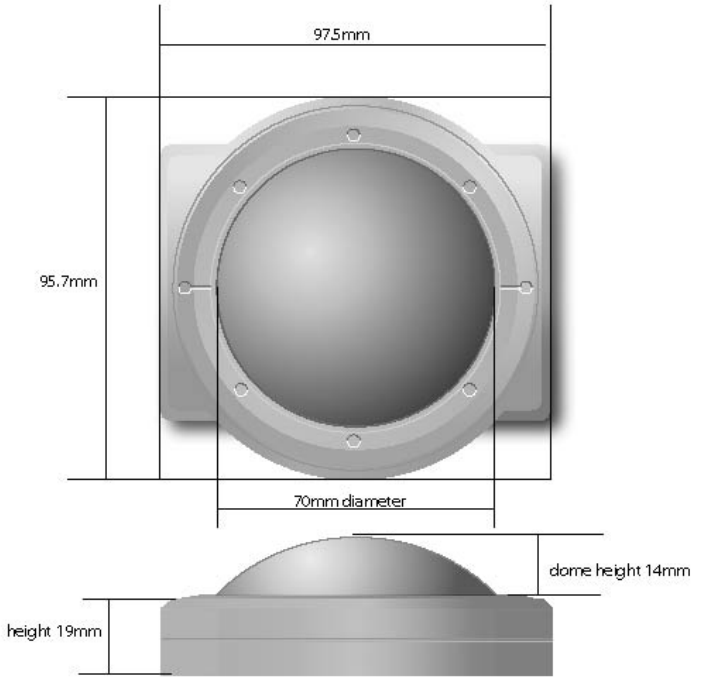
After a Cold Start, all Outputs will be reset to 0V, or the off state. After a Warm Start the outputs remain in their previous state.

After a Warm or Cold Start, the Inputs do not activate their programmed Responses regardless of their state is on or off.

After a Warm or Cold Start, the default X10 House code is “A” and the Unit Code is “1” for the X10 IR receive function. Hence if an X10 Function code is sent from UR24 or Pronto, the complete X10 signal transmitted to the power line will include the default A1 code.

IRD01 IR Dome

The IRD01 IR Dome contains 8 IR Transmitters and one IR receiver enclosed in an attractive infrared transmissive plastic dome. It takes the place of IR01Ws and IRR01. The IRD01 is connected to an RIO01.



This can be mounted on the ceiling of a room to allow IR signals to be sent to any remote-controlled appliances within the same room on the line of sight. The 8 IR transmitters are positioned around the circumference of the printed circuit board to achieve 360 degrees coverage. The angle of the individual IR leds can be adjusted slightly if required to point towards an infrared receiving appliance. In practice, infrared signals can bounce off the walls in a room to reach areas which may not be on the direct line of sight. A single IR receiver in the centre of the printed circuit board allows Comfort IR codes to be received which will activate Received IR Responses to perform any programmed task.

Installation

Remove the top housing from the IR Dome by turning the screw on the flat side. Mount the bottom housing to the ceiling using the two mounting holes which are located diagonally across. There are knock-out holes where the plastic can be cut off to allow cable entry from the bottom and the side.

Replace the top cover with the dome back over the bottom housing and screw in to secure.

Connections

There are 5 colour-coded wires which are to be connected to the RIO.

J2 - RX is connected to any RIO Input. This is the IR Receive signal.

J2 - GND is connected to the Ground (0V) on the RIO.

J1 - TX is connected to an output on the RIO which is programmed to send IR signals

J1 - 12V is connected to the 12V output of the RIO

J1 - LED is connected to the RIO output corresponding to the RIO input which is receiving the IR signal (from J2 - RCS). For example if J2 - RCS is connected to RIO Input 1, J1 - LED should be connected to RIO output 1. This signal is connected to the red LED (D2) which lights up when a valid Comfort IR signal is received by the IR receiver. This is visible through the dark IR lens, and is useful as an indication.

The 5 wires should be connected by twisted pairs to the RIO. The following signals should be twisted together (Rx and GND), (TX and 12V), with J1 - LED being the odd one out which can be twisted with a spare wire.

Hence each IRD01 is connected to 1 input and 2 outputs of an RIO01. This means that an RIO01 can support 4 IRD01s (4 inputs, 8 outputs) with 4 inputs free. If the LED indicator on the IRD01 is not required or connected (RIO shunts must be set accordingly), then each RIO01 can support 8 IRD01. However, it is recommended that the LED indication on the IRD01 be used since it gives positive confirmation to the user that the IR signal was actually received.

RIO Shunt Settings (J2)

J2- P: any position

J2- Q: Open - the outputs will blink once when a valid IR signal (Comfort or X10 code) is received at the corresponding input. The corresponding output should be connected to the LED signal at the IR Dome

J2- R: Closed

J2- S: Not in use, should be closed.

IR Dome Location Constraints

The IR dome should be mounted in a location which does not have a direct exposure to sunlight, which can interfere with the IR signal reception. In a room where the sun shines directly through the windows, mount the IR Dome in the part of the room away from the source of sunlight. The IR reception in such a location can be improved by closing the curtains

Fluorescent lights are also a source of IR interference. Mount the IR Dome at least 1.5 meters away from fluorescent lights, especially energy saving types which emit more in the infrared range.

Take note that the IRD01 transmits the same IR code through all its 8 IR transmitters. If there are more than 1 appliance in the same room which uses the same IR codes, both will be controlled at the same time. For example if there are two air-conditioners or two TV sets of the same model in the same room, they would be controlled at the same time.

Technical Specifications

Current when Idle:	< 1 mA
Current when transmitting	approximately 500 mA (burst)
Transmission angle for each LED	+/- 45 degrees
Transmission distance	4 meters at +/- 45 degrees
Receiving angle	+/- 45 degrees
Receiving Distance	5 meters with RC01

History

1.0.7 (9 Sept 2006) - Added locations for FS24 and FS34

1.0.6 (2 July 2004) - added IR Dome

Document Title:	RIO Manual
Filename	rioman.lwp
Version:	1.0.7
Date Last Modified	9 Sept 2006
Comfort Firmware:	Outside 5.054