



Hardware Manual

Multi-Function Receiver Manual

Revision 4.1 issued November 2022

This document is subject to change without notice.

TABLE OF CONTENTS

1.	SCOPE.....	3
1.1	IDENTIFICATION	3
1.	2R2002 Multi-Function Receiver	3
1.2	PRODUCT OVERVIEW.....	3
2.	TECHNICAL INFORMATION	4
2.1	RECEIVER SPECIFICATIONS.....	4
2.2	RECEIVER SETTINGS	5
2.3	ADVANCED RECEIVER SETTINGS.....	7
2.4	CONNECTION CABLE	9
2.5	RECEIVER CONNECTIONS	10
2.6	LED INDICATION	11
3.	TROUBLE SHOOTING.....	12
4.	FREQUENTLY ASKED QUESTIONS	14
4.1	How does Wiegand Buffer Time work?	14
4.2	What is the Voltage and current draw on a daisy chain of receivers?.....	14
4.3	Does the Wiegand Buffer Timeout also control the Serial Output?	14
4.4	How do I Return the Receiver to Factory Settings?	15

Limited Warranty:

PROTRAC iD AUSTRALIA PTY LTD, or its suppliers or agents are not liable for any consequential or third party damages howsoever arising. PROTRAC iD AUSTRALIA PTY LTD warrant parts supplied, which, when returned to us by pre-paid freight, will be replaced or repaired at the sole discretion of PROTRAC iD AUSTRALIA PTY LTD if found to be defective due to component failure or bad workmanship, during the 12 month warranty period.

1. SCOPE

1.1 IDENTIFICATION

Protrac iD Multi-Function Receivers can be used in various applications such as: personnel monitoring/duress, security access control, asset monitoring/tracking, vehicle monitoring, vehicle control systems, and building management applications.

This hardware manual covers the following receivers:

- 2R2002
- 2R2102
- 2R2202
- 2R2902
- 4R2002
- 4R2202



1. 2R2002 Multi-Function Receiver

1.2 PRODUCT OVERVIEW

The Multi-Function Receiver detects and decodes Radio Frequency (RF) transmitted signals from the Protrac iD range of tags.

Protrac iD Multi-function receivers plug directly into almost any access control system using the Wiegand international standard, or connect to third party systems using standard ASCII RS232 communications.

Tag Series and Description	Receiver
2T6022 Series – 433MHz Secure Bracelet Tag (anti-tamper wrist band)	2R2002
2T7022 Series – 433MHz Bracelet Tag	2R2002
2T8022 Series – 433MHz Asset/Vehicle Tag, Industrial Tag (excludes Temperature Tags)	2R2002
2T8202 Series – 433MHz Temperature Tag	2R2202
2T9022 Series – 433MHz Personnel Tag, 3 IN 1 Duress Tag	2R2002

Wavetrend tags	2R2902
4T7022 Series – 916MHz Bracelet Tag	4R2002
4T8022 Series – 916MHz Asset/Vehicle Tag, Industrial Tag (excludes Temperature Tags)	4R2002
4T8202 Series – 916MHz Temperature Tag	4R2202
4T9022 Series – 916MHz Personnel Tag, 3 IN 1 Duress Tag	4R2002

Consult User Manual for Protrac iD Tags for all other compatible tag variations.

2. TECHNICAL INFORMATION

2.1 RECEIVER SPECIFICATIONS

PARAMETER	Multi-Function Receiver
Environmental	
Operational Temperature	-10°C to +60°C
Storage Temperature	-20°C to +70°C
Humidity	5% to 90% (non condensing)
Physical	
Size	110 x 63 x 22
Weight	35g
Material	PVC
RF Input	BNC (female)
Colour	2R2002: Grey, 2R2202: Aqua, 2R2902: Cream, 4R2002: Green, 4R2202: Unknown
RF Specifications	
Rx Frequency	2R2002, 2R2202, 2R2902: 433.92Mhz 4R2002, 4R2202: 916.5Mhz
Sensitivity	-103 dBm
Bandwidth	702Khz
Power	
Voltage	12-24 VDC
Current	38mA

Model 2R2102 Receiver is used in daisy chain networks only. It communicates using the RS422 port section 2.5.2. RS232 and Wiegand ports and I/O connections are not provided.

Multi-Function Receiver Manual

2.2 RECEIVER SETTINGS

PARAMETER	DEFAULT SETTING	VALID SETTINGS	EXPLANATION
Wiegand Buffer Time	5	0 to 255	The maximum setting is 255 in seconds. This is the interval or delay between re-sending the same tag ID after it is first seen and sent whilst the tag is still being seen. This prevents used for differentiating receivers connected to the same continuously repeating the same tag messages when they COM port. Depending upon power supply configuration and data traffic are still in range.
Receiver ID	1	1 to 255, inclusive	This is the time allowed for a tag to be considered an existing tag that has remained in range. The tag number is sent for each tag when it is first received and this timer is started. Up to 100 different tags are individually buffered. When the tag is seen during this timeout period, the timer is restated and the tag number is not resent. Provided each tag is seen before the timeout expires, the tag number will only be repeated at the time set in the previous buffer time. If the tag is not seen before the end of the timer the tag is deleted from the buffer list. When the tag is next received, the tag number is outputted and added to the buffer list as a new tag and the sequence restarted.
Wiegand Buffer Timeout	10	1 to 255, inclusive	Used in Delayed Output mode only. Only available in codes. The tag will only be recognized if the Receiver CC and firmware version 45* or later. Each tag on the Wiegand Buffer List has a running count stored for it that gets incremented each time the tag is seen. Working system stores things determined by how long a tag is not outputted by the receiver.
Wiegand Delay Count	0	0 to 255, inclusive	E.g.: If Wiegand Delay Count = 5, and the tag heartbeat is 1.5 seconds, the receiver will output the tag packet (Protrac iD protocol) every fifth transmission, or once every 7.5 seconds.
Mode	Auto	Manual	Allows multiple receivers, each with a unique Reader ID, to be connected to a single serial port without having data collisions. The Receiver stores valid tags (up to 6 tags by default) until the Receiver receives a command from a controller to transmit a tag. When this command is received the Receiver will output one valid tag packet if there is one in the tag buffer, or an empty packet if there are none. This mode MUST ONLY be used when the receiver is connected to a controlling device.
		Auto	The Receiver automatically outputs tags from both the RS232 and Wiegand output ports whenever a tag is seen.
		RS232.5	The receiver will output a modified tag packet each time a valid tag is received. The modified tag packet is the 5 digit Wiegand Tag Number as ASCII characters followed by the CR LF characters. This data is output from the RS232 port at the baud rate set in the receiver.

		RS232.8	The receiver will output a modified tag packet each time a valid tag is received. The modified tag packet is the 3 digit Wiegand Site Code and the 5 digit Wiegand Tag Number as ASCII characters followed by the CR LF characters. This data is output from the RS232 port at the baud rate set in the receiver.
		RS232.10	The receiver will output a modified tag packet each time a valid tag is received. The modified tag packet is a 10 byte ASCII string ("02", 3 digit Wiegand Site Code and the 5 digit Wiegand Tag Number) sent on the RS232 port followed by <CR><LF>. This data is output from the RS232 port at the baud rate set in the receiver.
		First Last ASCII	<p>The receiver will output an ASCII message when a tag is first received and then again when the tag is removed from the Wiegand buffer.</p> <p>To change the amount of time for a tag to be removed from the Wiegand Buffer, change the Wiegand Buffer Timeout.</p> <p>First seen ASCII message format:</p> <p>"11", 3 digit Wiegand site Code, 5 digit Wiegand tag number, CR, LF</p> <p>Last seen ASCII message format:</p> <p>"02", 3 digit Wiegand site code, 5 digit Wiegand tag number, CR, LF</p>
		First Last Packet	<p>Only available in firmware version 43* or later.</p> <p>The receiver will output a Protrac iD protocol message when a tag is first received and then again when the tag is removed from the Wiegand buffer.</p> <p>To change the amount of time for a tag to be removed from the Wiegand Buffer, change the Wiegand Buffer Timeout.</p> <p>First seen Protrac iD protocol message:</p> <p>Contains all tag information as per normal Protrac iD protocol message</p> <p>Last seen Protrac iD protocol message:</p> <p>Shows tag number and Customer code, but all other values are set to 0.</p>
		Delayed Output	<p>Only available in firmware version 45* or later.</p> <p>The receiver will only output a tag (Protrac iD protocol</p>

			<p>is seen, as long as the tag is not removed from the Wiegand Buffer List.</p> <p>Each tag on the Wiegand Buffer List has a running count stored for it that gets incremented each time the tag is seen, and reset when the tag is outputted in this mode.</p> <p>E.g.: If Wiegand Delay Count = 5, and the tag heartbeat is 1.5 seconds, the receiver will output the tag packet (Protrac iD protocol) every fifth transmission, or once every 7.5 seconds.</p>
Baud Rate	115202	115202 57602 38402 19202 9602	The Baud rate for communication with the receiver.
TCP Time	5	0 to 255, inclusive	The default setting. Does not affect operation of the receiver.

2.3 ADVANCED RECEIVER SETTINGS

WARNING: Be very careful when making changes to the Advanced Receiver settings. So that you can return the receiver to its original settings, ensure that you record all of the current settings in the receiver BEFORE making changes.

PARAMETER	DEFAULT SETTING	VALID SETTINGS	EXPLANATION
RSSI Ext			<p>Receivers using Firmware Version 43* or greater have the ability to filter groups of tags to different RSSI levels.</p> <p>This can be used so that tags placed on metal (that have a weaker signal) have a lower RSSI cut off than tags not on metal (that have a stronger signal), so they will both be detected at the same distance.</p> <p>The Receiver does this by separating tags into bands, each band with a different RSSI setting.</p> <p>E.g.:</p> <p>Band 0 Top Tag is 1022, RSSI is 102</p> <p>Band 1 Top Tag is 2002, RSSI is 0</p> <p>Band 2 Top Tag is 3022, RSSI is 202</p> <p>This means that:</p> <p>All tags up to tag 1022 (inclusive) have an RSSI cut off of 102</p> <p>All tags from 1021 to 2002 (inclusive) have an RSSI cut off of 0</p>

	All tags from 2021 to 3022 (inclusive) have an RSSI cut off of 202		
RSSI Ext: Band	0	0 to 255, inclusive.	
RSSI Ext: Tag No	16777215	0 to 16777215	
RSSI Ext: RSSI	0	0 to 255, inclusive	Receiver Signal Strength Indicator. The value set here determines the RSSI cut off value for received signals. Anything below the value set here is rejected, thus a LOWER number = GREATER range.
Tag Seen Count		1 to 255, inclusive.	<p>The number of times a tag must be consistently seen by the Receiver before it begins to output that tag number to the computer.</p> <p>A tag is seen consistently if it is never deleted from the Wiegand Buffer. See RECEIVER SETTINGS: Wiegand Buffer Timeout.</p>
I/O Control: I/O Control 1	<p>Some receivers offer extra digital output pins that can be activated when the receiver detects certain tags. For the Protrac iD range of Multi-Function Receivers, these are the pins of the J3 connector.</p> <p>These outputs can be in the form of serial data or pulses designed for driving a relay.</p> <p>Receivers using Firmware Version 45* or greater have this functionality.</p>		
	None	None	I/O control is deactivated.
		Serial Data Control	Serial Tag and RSSI data is outputted on D01 line.
		Tag LED	Drives an output on D01 line whenever the Tag LED on the receiver is on. The Tag LED flashes each time a tag is detected.
		Wiegand Tag LED	Drives an output on D01 line whenever data is sent to the Wiegand output. This is a single pulse, at least 70mSeconds long, for the duration of the Wiegand output.
I/O Control: I/O Control 2	Same as I/O Control 1, but on the D02 line instead of the D01 line.		

The pins of the J3 Digital I/O connector are:

White Dot	Pin	Pin
	1: +12V	2: GND
	3: Digital Input 1 (DI1) 0V = OFF 5-12V = ON	4: Digital Input 2 (DI2) 0V = OFF 5-12V = ON
	5: Digital Output 1 (DO1) Open Drain: 1A Max. 15V Max. Relays MUST be fitted with a diode.	6: Digital Output 2 (DO2) Open Drain: 1A Max. 15V Max. Relays MUST be fitted with a diode.

2. * *The firmware version loaded onto your receiver can be checked in Reader Setup Utility.*

2.4 CONNECTION CABLE

A custom lead and a power supply are required to connect a Multi-Function receiver to a PC (except model 2R2102 which requires a gateway). The lead is available from Protrac iD (Part Number: **2PL2002**). The lead is a “Y” cable which connects the receiver (RJ45 plug), to the PC serial port (DB9F plug), and power supply (bare ends for screw terminals). The red wire connects to the regulated +12V terminal of a power supply and the black to 0V. See figure below for details.

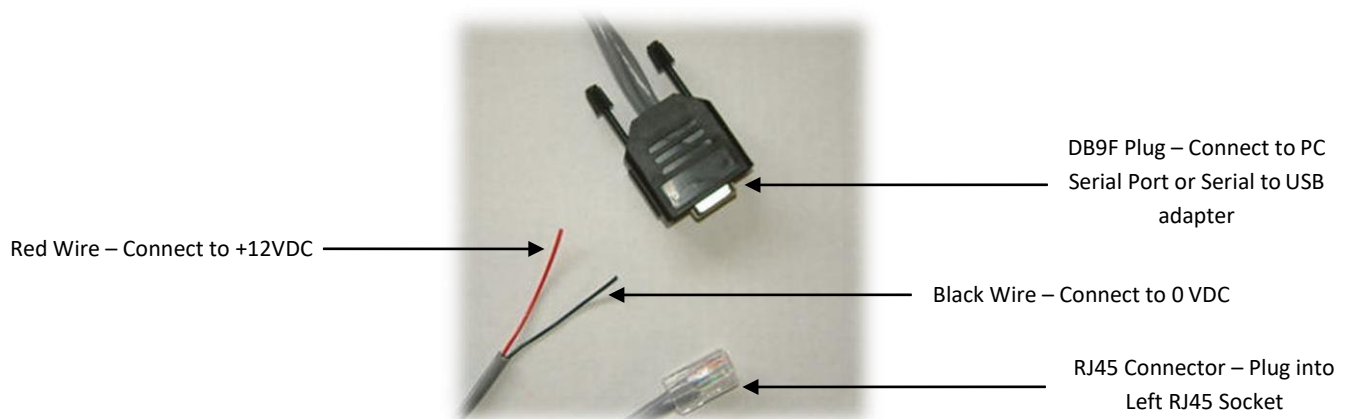


Figure 2

A “Y-Cable” complete with pre wired plug pack and power supply is available for Australia and New Zealand (Part Number 2PL2002P).

Alternatively, make a lead as pin to pin connections 2.5 below..

2.5 RECEIVER CONNECTIONS

2.5.1 - The RJ45 plug of the 2PL2002 programming lead plugs in to the **LEFT RJ45 SOCKET**. This uses the RS232 Pins (see table below) for programming one receiver at a time.

2.5.2 - A **2PCI202^** network interface must be used if multiple receivers are to be connected to a single COM port. Each receiver to be connected to the same COM port needs to have a unique Receiver ID (see Protrac iD Reader Setup Utility 6.9 Manual for how to change the Receiver ID) and be in Manual mode before connecting each receiver on the network.*

A network of more than one receiver uses both the **LEFT RJ45 SOCKET** and **RIGHT RJ45 SOCKET**. This applies to both LEFT and RIGHT RJ45 SOCKETS. For networked communications the RS422 pins are used instead of the RS232 pins.

3. *^ If the receivers are all being powered by the Gateway, up to 10 receivers (depending upon cable characteristics and length) can be connected. If the receivers are being powered by different sources at intervals of 10 receivers, up to 255 receivers can be connected to a single gateway if data traffic from each receiver is low. This is to ensure that the Voltage and Current passing through the gateway and receivers remains within specified ranges.*

** See Multi-Function Receiver System Topology Diagram.*

2.5.3 - For connecting the receiver to an access control system use only the **RIGHT RJ45 SOCKET**.

Pin	Pin Name	DB9
1.	RS232TX	2
2.	RS232RX	3
3.	RS422TX+	
4.	0V	5
5.	+12V DC	
6.	RS422TX-	
7.	RS422RX+	
8.	RS422 RX-	

LEFT RJ45 SOCKET



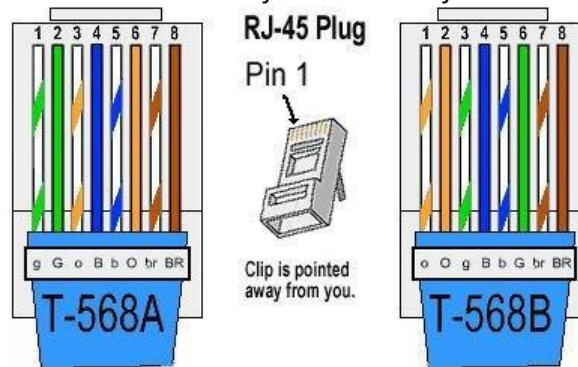
Pin	Pin Name
1.	Wiegand D0
2.	Wiegand D1
3.	RS422 TX+
4.	0V
5.	+12V DC
6.	RS422 TX-
7.	RS422 RX+
8.	RS422 RX-

RIGHT RJ45 SOCKET

Multi-Function Receiver Manual

The figure below shows the pin and colour configuration for both standards (T-568A, T-568B) of CAT-5 leads which can be used to make up a programming lead.

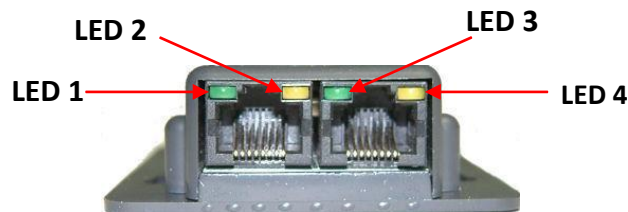
Note: The SAME wiring standard MUST be used for both ends of the CAT-5 cable.



WARNING - The right hand RJ45 Jack **MUST** be unplugged before the 2PL2002 lead is plugged in. Damage to the receiver and/or power supply and/or access control equipment may result if this is not done.

2.6 LED INDICATION

LED indication is important to determine if the Multi-Function receiver is functioning correctly. The table below describes the status of each LED.



LED Number	LED Colour	LED Description	Status Indication
1	Green	Power	On Solid
2	Amber	Valid Tag Received	Flashes when valid tag is received
3	Green	Receiver Transmit	Flashes when receiver transmits data
4	Amber	Auto Mode	On Solid when set to Auto Mode.
		Manual Mode	Off when set to Manual Mode and flashes when a valid command is received

3. TROUBLE SHOOTING

PROBLEM	DIAGNOSTIC	FIX
No LEDs are active	No Power	Turn Power On and check Y-Cable power connections. See Figure 1 in section 2.2
	Incorrect voltage supplied	Check supplied voltage is in correct voltage range (8.5-24VDC)
	Other (Faulty Reader) or Reader has been damaged by not unplugging RIGHT RJ45 Plug before the 2PL2002 is plugged in.	Consult Distributor for further information.
LEDs active but cannot communicate with receiver	RJ45 plug plugged into incorrect socket.	Plug RJ45 plug into LEFT socket (See section 2.3 of this manual)
	DB9 of Y-Cable not connected to PC or Serial to USB adapter.	Make sure DB9 is connected to PC or Serial to USB adapter.
	Result is from a Software Problem	Consult Multi-Function Software Manual for trouble shooting.
	Incorrect pins used for RS232 communications	Check RJ45 plug and DB9 pin connections if custom cable is used. (See Section 2.3 of this manual for connections)
	Receivers in the daisy chain are not successfully communicating with the PC, but when individually checked are ok.	Incorrect settings/not being polled
	Not enough power	The 2PCI202 is only able to supply power to a maximum of 16 receivers*. Ensure that receivers beyond this are supplied with power from different sources at a maximum interval of 16 receivers* per power supply.
	Too much noise on the line	Note: <i>this fix does not fix all systems with this problem, and may make the problem worse. If this is the case, remove the End of Line resistors and consult Distributor.</i> On the last receiver in the daisy chain: Add a 150Ω resistor across the

Multi-Function Receiver Manual

		2 Tx pins Add another 150Ω resistor across the 2 Rx pins
--	--	--

*This assumes that the total length of cables used is less than 50m when using standard Cat-5 cable between readers. For longer cable lengths, power may need to be injected at shorter intervals.

4. FREQUENTLY ASKED QUESTIONS

4.1 How does Wiegand Buffer Time work?

Wiegand Buffer Time is only used when the Receiver is in Auto mode, and together with Wiegand Buffer Timeout determine whether or not to output a tag on the Wiegand output (right RJ45 plug). E.g: The Receiver is in Auto mode, with Wiegand Buffer Time = 5 and Wiegand Buffer Timeout = 10.

1. Tag 1234 moves into range of the 2R2002.
 - a. The 2R2002 outputs tag 1234 on the left (as Protrac iD Protocol) and right (Wiegand Protocol) RJ45 sockets.
2. 3 seconds later, Tag 1234 is seen again.
 - a. The 2R2002 outputs tag 1234 on the left RJ45 socket ONLY (Because it was last transmitted from the right RJ45 socket less than 5 seconds ago. See 2.a.i)
3. 3 seconds later, Tag 1234 is seen again.
 - a. The 2R2002 outputs tag 1234 on the left and right RJ45 sockets (Because it was last transmitted from the right RJ45 socket more than 5 seconds ago. See 2.a.ii).
4. Tag 1234 moves out of range of the 2R2002.
 - a. After 10 seconds (Wiegand Buffer Timeout) of not seeing Tag 1234, the tag is removed from the 2R2002's memory.

4.2 What is the Voltage and current draw on a daisy chain of receivers?

The voltage range is 12-24VDC.

The current required depends on the Voltage and the number of receivers.

As the voltage increases, the current required by each receiver decreases. For example:

Voltage	Current	Power
12VDC	38mA	0.456W
15VDC	33mA	0.495W
20V	30mA	0.6W

So a daisy chain of 16 receivers at 20 VDC will draw 480mA.

Note: For long lengths of cable a higher voltage is better.

4.3 Does the Wiegand Buffer Timeout also control the Serial Output?

For some modes, yes.

The modes that are affected by Wiegand Buffer Timeout are as follows:

Multi-Function Receiver Manual

1. First Last ASCII
 - a. Wiegand Buffer Timeout is used to determine how long a tag needs to be consistently NOT seen before the Last seen message is sent.
2. First Last Packet
 - a. Same as First Last ASCII
3. Delayed Output
 - a. Any recently seen tags are kept on a list and outputted once every Delay Count times that they are seen, with “Recently Seen” being defined as within the Wiegand Buffer Timeout.

4.4 How do I Return the Receiver to Factory Settings?

4. Ensure that the receiver to be reset is the only one connected to the COM port
5. Connect the receiver to power
6. Using Protrac iD Reader Setup Utility, open the COM port at 115202 baud
7. In the Reader Setup window, select Receiver Number 0 to talk to all Receivers (no matter what their receiver ID)
8. Click “Get” receiver ID.
 - a. If the Receiver ID changes to a different value, this is the current Receiver ID and the selected Baud rate is the current Baud rate set in the receiver. Proceed to step 4.
 - b. If an error message is raised, close the COM port and try the next Baud rate, going through these steps again until all baud rates have been attempted.
 - c. If the value stays at 1, change the value and click “Get” again.
 - i. If the value returns to 1 this is the current Receiver ID, and the selected Baud rate is the current Baud rate set in the receiver. Go to step 4.
 - ii. If the value stays the same again, close the COM port and try the next Baud rate, going through these steps again until all baud rates have been attempted.
9. Once the correct baud rate and receiver ID has been found, you can set the receiver settings back to the factory defaults. See section 2.2, Default Setting column for the default settings.