



TPPL Modbus RTU and TCP

Revision History

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MODBUS RTU AND TCP INSTALLATION AND SETUP

Contents

1	Introduction	5
1.1	How to Use this Document.....	5
1.2	Overview.....	5
2	Safety Notices	6
3	How to Install the Bus Interface Board (BIB) (Repair, Upgrade or OEM)	6
3.1	Modbus RTU Cable	8
3.2	Modbus TCP Cable	8
3.3	Modbus RTU and TCP Electrical Connections.....	8
3.4	Modbus Chaining / Multi-Drop Mode.....	9
4	How to Configure Modbus RTU / TCP Parameters.....	10
4.1	How to Configure the Master / Host PC	10
4.2	How to Configure the TPPL Modbus RTU Settings	10
4.3	How to Configure the TPPL Ethernet TCP Settings.....	10
4.4	Modbus Register Allocation for Function 02 – Read Input Status	11
4.5	Modbus Register Allocation for Function 04 – Read Input Registers	11
4.5.1	Analogue Registers (Integer).....	11
4.5.2	Analogue Registers (Float)	12
4.5.3	Animation Registers.....	12
4.6	Register Allocation for Function 03 / 06 / 16 – Read / Write Holding Registers	13
4.6.1	Query Poll Registers.....	13
4.6.2	Query Types Available.....	14
4.7	Modbus RTU Command Types	14
4.7.1	Modbus RTU Command Poll Registers	15
4.8	Exception Responses.....	16

MODBUS RTU AND TCP INSTALLATION AND SETUP

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MODBUS INSTALLATION

1 Introduction

Modbus is a well supported digital data communication protocol that provides a set of standard commands by which system data can be communicated.

Touchpoint Plus (TPPL) is supplied with Modbus software as a default, but the Modbus Bus Interface Board (BIB part number TPPLORTU) is an optional extra for those customers who want to control TPPL via the Modbus protocols.

Normally the BIB is factory or OEM installed, but it can be fitted or replaced in the field by an authorised Honeywell Field Engineer, or by a qualified person trained in accordance with the TPPL Technical Handbook and these instructions.

1.1 How to Use this Document

This document is provided for the use of Honeywell personnel and Honeywell approved 3rd-parties only. Its utilisation requires a high level of computer skill and a competent knowledge of Industrial Gas Detection Systems and Touchpoint Plus.

Incorrect use of this document or its procedures could result in unexpected and dangerous consequences. Please read the *Disclaimer* and *Warranty* before proceeding.

This document is designed to be a technical reference source that should be used in conjunction with the following documents:

- <http://www.honeywellanalytics.com>. *Touchpoint Plus Technical Handbook*. (Search for 'Touchpoint Plus' then click 'Technical Handbook'.)
- http://modbus.org/docs/PI_MBUS_300.pdf. *Modicon Modbus Protocol Reference Guide*. (Check your download folder if the page appears blank.)

This document uses [Button name] and Menu>Item>Command to signify tasks that are carried out on the TPPL Touchscreen.

1.2 Overview

The TPPL Modbus Interface provides a facility for digital communication between the TPPL and an external computer system.

Principal features:

- Operates as a Modbus Remote Terminal Unit (RTU) slave device node.
- Operates as a Modbus TCP slave device node.
- Can be used in Modbus Multi-Drop mode.
- Supports functions 02, 03, 04, 06 and 16 of the Modbus protocol.
- Provides sensor gas readings and alarm status for Fault, Inhibit, Warning, A1, A2, A3, STEL, LTEL and Rate alarms from all input channels in the system.
- Supports commands to Inhibit, Reset and Acknowledge for Modbus RTU only.
- Asynchronous serial link configurable for baud, bit-rate and parity.

Notes:

- The Modbus broadcast commands are not supported and will be ignored. i.e. it has no output registers at this time.
- There are no standard Modbus function formats defined for the communication of data from a gas detection system so the host computer system must be programmed to interpret the signal and status data made available by TPPL.
- It is recommended that the host computer system should, as a minimum, be programmed to use Function 02 to collect alarm and status data from all TPPL channels.
- Full details of the Modbus protocol can be found in the Modicon Modbus Protocol Reference Guide PI-MBUS-300 mentioned above.
- The addressing conventions and register values used follow those set by Modicon. The first digit of the on-board memory address refers to the data type stored in the register and therefore defines the Modbus function command that should be used when polling it.

MODBUS INSTALLATION

2 Safety Notices

The following safety notices should be read in conjunction with the safety notices and procedures contained in the Touchpoint Plus Technical Handbook.



DANGER

TPPL Safety systems will be inoperative during parts of this procedure. Ensure that a risk assessment is carried out and that alternative safety arrangements are in place before commencing.



WARNING

The equipment specified in this manual is only to be installed by the Manufacturer's trained personnel, or by competent persons trained in accordance with the Manufacturer's installation instructions.



WARNING

There is a risk of electric shock when carrying out this procedure. Ensure that the system and backup batteries are electrically isolated and that residual power is allowed to dissipate before opening the enclosure.



WARNING

If the TPPL relays are switching mains voltages, hazardous live terminals may be present within the Relay Output Modules even if the TPPL is electrically isolated.



Caution – Electrostatic Hazards

All electronic and PCB assemblies contain static sensitive components. Take anti-static precautions to minimise the risk of damaging components through electrostatic discharge.



Caution

The SD Card should be removed before attempting to remove the Control Module cover panel.

3 How to Install the Bus Interface Board (BIB) (Repair, Upgrade or OEM)

To fit or replace the BIB:

1. Power off and isolate the mains supply and backup batteries and any mains-switching relays.
2. Open the Controller enclosure to access the controller cover panel. (See figure on next page.)
3. Remove the three cover securing screws (arrowed).
4. Carefully slide the cover off.

MODBUS INSTALLATION

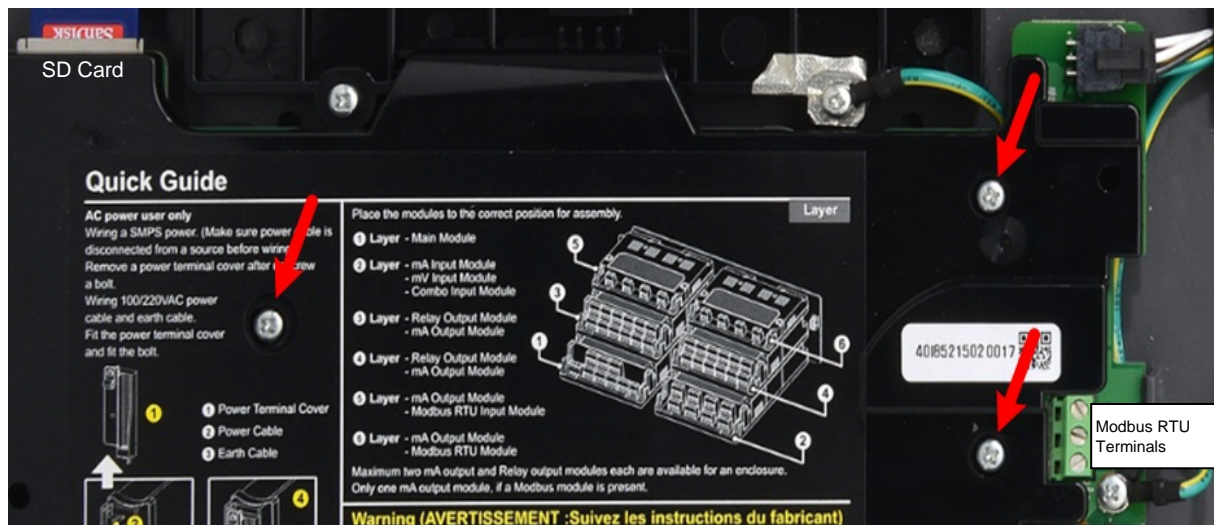


Figure 1. Controller Cover Panel Screws (Arrowed)

5. Locate the Bus Interface Board (BIB) position to the right of the MOBO (see picture below).
6. If required, remove the existing BIB by pulling gently, and place it on a static free surface.
7. Observing the correct orientation, align the connectors and gently push the new BIB into place.

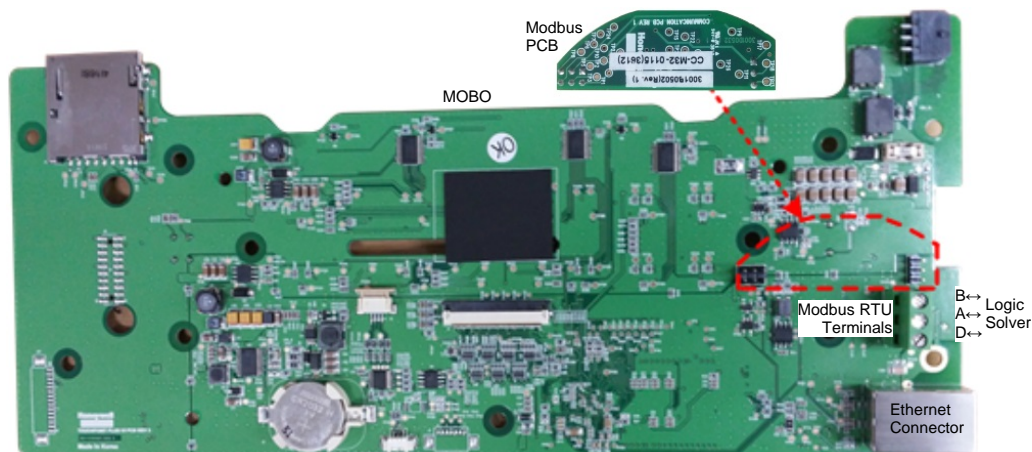


Figure 2. Bus Interface Board (BIB) Fitting

8. Carefully slide the cover back into place and refit / tighten the securing screws.
9. Connect the Modbus cables as shown below.
10. Re-connect all other cables as required.
11. Switch on the batteries and Mains power.
12. Wait for the system to initialize and check/test that everything is working correctly.

MODBUS INSTALLATION

3.1 Modbus RTU Cable

The Modbus RTU cable should be Belden 3105A (22 AWG) or similar shielded data communication cable connected to a router operating at 4800 Baud minimum (>9600 Baud preferred).

3.2 Modbus TCP Cable

The Modbus TCP cable should be CAT 5/5E or higher shielded data communication cable suited to the installation distance and ambient environment factors.

In addition:

- Spurs shall not be longer than 1m each, and shall not exceed 10m combined total length.
- The maximum cable length without line repeaters is 1.2km (1200 m, 1300 yd).
- The maximum wire size is 1.5 mm² (15 AWG).

3.3 Modbus RTU and TCP Electrical Connections

The electrical connections are shown below:



Caution

Some transceiver manufacturers have been known to incorrectly reverse their RS485 Data terminals, which can cause Tx/Rx to fail. If this happens, simply swap over the TPPL's A and B cables and then re-test.

MODBUS RTU	Label	Terminal ID	Logic Solver
Drain	D	1	D
Data +	A (D+)	2	A (D+)
Data -	B (D-)	3	B (D-)

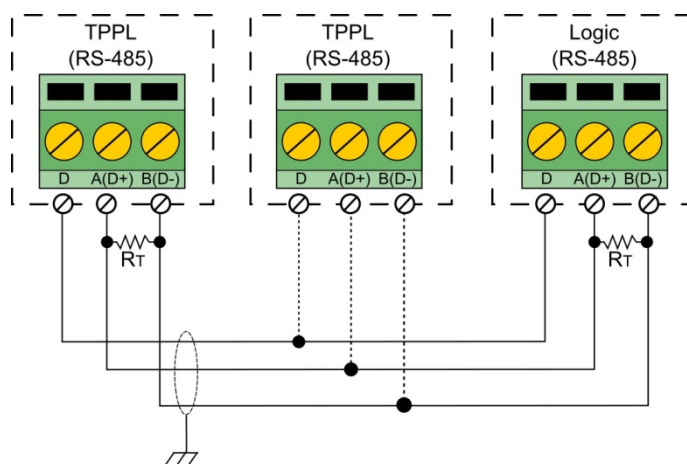


Figure 3. Modbus RTU Connections

Note: You should connect a 120Ω termination resistor (R_T) between A and B to prevent reflections on the RS485 circuit if TPPL is the last node in a Modbus system highway.

Note: The external R_T is not needed if the logic solver side has an internal R_T .

MODBUS INSTALLATION

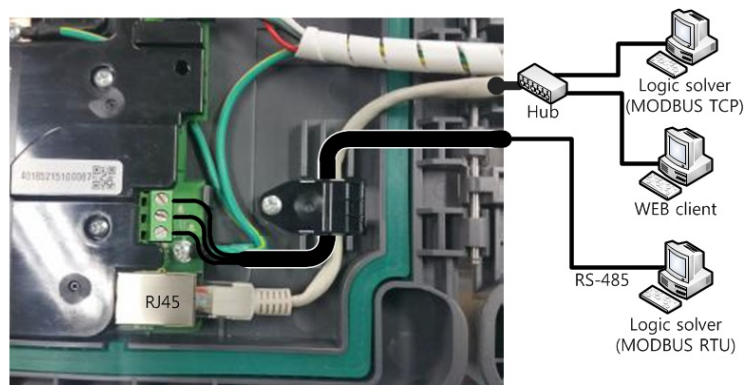


Figure 4. TPPL Modbus TCP / RTU / Web Client Connections

Note the use of the cable clamp above.

3.4 Modbus RTU Chaining / Multi-Drop Mode

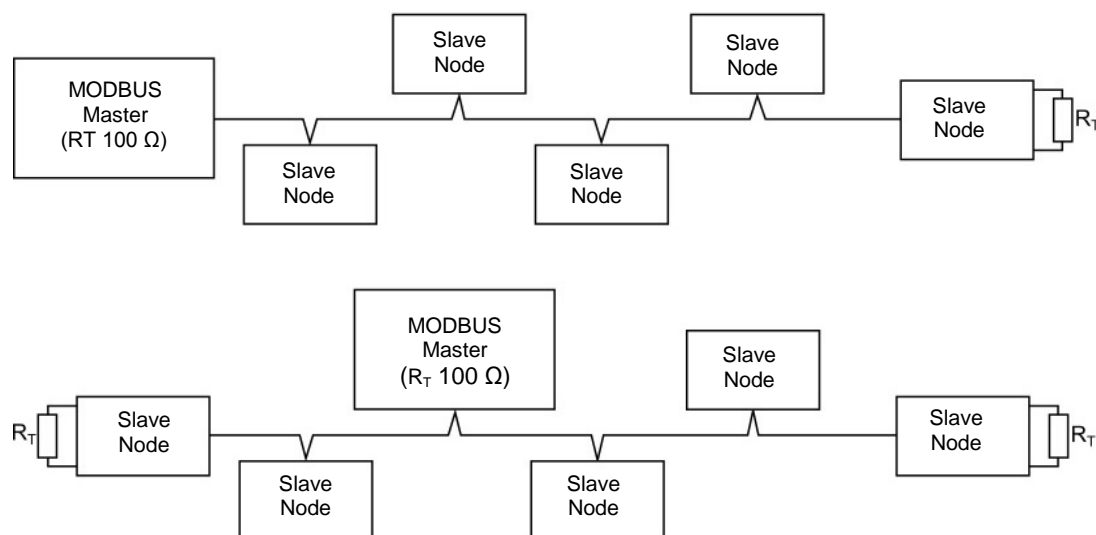


Figure 5. Two Modbus Chaining Examples (other layouts may also be used)

Note: TPPL can be any slave node, and it can support one master node with up to 31 slave nodes when in Multi-Drop Mode.

MODBUS CONFIGURATION

4 How to Configure Modbus RTU / TCP Parameters

4.1 How to Configure the Master / Host PC

Before starting, please refer to the documentation supplied with the host computer for details of its communication and Modbus configuration, and to the TPPL Technical Handbook for details on everything else.

Note: It is recommended that the host computer is configured to provide at least two retries in the event of a communication frame loss with a minimum delay of 1 second between each poll, and a minimum timeout of 2 seconds.

4.2 How to Configure the TPPL Modbus RTU Settings

To configure the TPPL RTU:

1. Login to TPPL as Administrator or Service.
2. Touch Menu >Configuration>Network>Modbus RTU.
3. Set Slave Address, Baud, Parity and Databits (see Table 1 below).
4. Touch [Finish].

Parameter Name	Default Setting	Value Range	Comment
Slave Address	1	1 to 247	Each node connected to the RS485 highway must have a different address setting.
Baud	9600	4800, 9600, 19200	Should be set to correspond to the host network Baud.
Parity	None	Even, Odd, None	Should be set to correspond to the parity checking set on the host system.
Databits	8	8	TPPL Modbus uses 8 data bits and 2 stop bits

Table 1. Modbus Parameter Settings

4.3 How to Configure the TPPL Ethernet TCP Settings

To configure the TPPL TCP:

1. Login to TPPL as an Administrator or Service.
2. Touch Menu >Configuration>Network>Ethernet
3. Select [Static IP address] and set the [IP address].
4. Touch [Finish].

MODBUS CONFIGURATION

4.4 Modbus Register Allocation for Function 02 – Read Input Status

This function reads the input channel status bits. Each status bit can have the value 1 = Active or 0 = Not active. For the Channel Type only, 1 = Analogue or 0 = Digital. There are twelve status bits for each channel.

Channel	Rate Alarm	LTEL Alarm	STEL Alarm	Alarm 3	Alarm 2	Alarm 1	Inhibit	Fault	No Data	Channel Type	Not Used	SIL Channel (Future Use)	Safe State (Future Use)	Warning	Acknowledged	Not Used
01	10001	10002	10003	10004	10005	10006	10007	10008	10009	10010	10011	10012	10013	10014	10015	10016
02	10017	10018	10019	10020	10021	10022	10023	10024	10025	10026	10027	10028	10029	10030	10031	10032
...																
16	10241	10242	10243	10244	10245	10246	10247	10248	10249	10250	10251	10252	10253	10254	10255	10256

Table 2. Modbus Input Channels

	Rate Alarm Summary	LTEL Alarm Summary	STEL Alarm Summary	Alarm 3 Summary	Alarm 2 Summary	Alarm 1 Summary	Inhibit Summary	Fault Summary	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used
System Summary	11025	11026	11027	11028	11029	11030	11031	11032	11033	11034	11035	11036	11037	11038	11039	11040

Table 3. Modbus System Summary

4.5 Modbus Register Allocation for Function 04 – Read Input Registers

There are three sets of input registers for each channel:

- The analogue signal expressed as a 16 bit signed integer value.
- The analogue signal expressed as a 32 bit floating point value.
- An animation value.

4.5.1 Analogue Registers (Integer)

Channel	Analogue Value (Integer)
01	30001
02	30002
...	
16	30016

Table 4. Modbus Channel Analogue Values

Note: The Integer format is a 16 bit signed integer, range -10000 to +10000 in steps of 0.1 %FSD. e.g. if FSD is 500 and the reading is 50, then the data will be 100 (10.0 %FSD).

MODBUS CONFIGURATION

4.5.2 Analogue Registers (Float)

Channel	Analogue Value (Float) Register 1	Analogue Value (Float) Register 2
01	30129	30130
02	30131	30132
...		
16	30159	30160

Table 5. Modbus Channel Analogue Values (Float)

Note: The Float format is a 32 bit floating point value in accordance with IEEE 754-2008.

4.5.3 Animation Registers

A group of values are allocated for Animation Registers 30065 to 30080. These are intended to be used by graphics packages for defining the colours of various screen objects based upon the status of a channel.

A 16 bit unsigned word format is used.

Channel	Animation Register
01	30065
02	30066
...	
16	30080

Table 6. Modbus Channel Animation Values

The data value for each register can be assigned to one of the following:

Status	Value
Channel operating normally	0
RATE alarm active	1
LTEL alarm active	2
STEL alarm active	3
A1 alarm active	4
A2 alarm active	5
A3 alarm active	6
Fault active	7
Inhibit active	8
Not used	9
Not used	10
No data available	>10

Table 7. Modbus Channel Animation RegisterAssignments

MODBUS CONFIGURATION

4.6 Register Allocation for Function 03 / 06 / 16 – Read / Write Holding Registers

All registers use 16 bit data words.

The Channel Type field identifies the channel as Input or Output. The decimal value 105 (= ASCII 'i') is used for Inputs. Function 16 can be used to write to the 40n01 to 40n04 and 41n01 to 41n05 (n = 0 to 9) ranges of registers only.

Caution: When using Function 6 or Function 16, ensure that the registers related to the command are completely filled before setting the Block Active flag, otherwise an unintended command may be performed.

4.6.1 Query Poll Registers

Query Poll Block	Block Active	Channel Type	Channel ID	Query Type	Result	Result String
1	40001	40002	40003	40004	40005	40006 to 40036
2	40101	40102	40103	40104	40105	40106 to 40136
3	40201	40202	40203	40204	40205	40206 to 40236
4	40301	40302	40303	40304	40305	40306 to 40336
5	40401	40402	40403	40404	40405	40406 to 40436
6	40501	40502	40503	40504	40505	40506 to 40536
7	40601	40602	40603	40604	40605	40606 to 40636
8	40701	40702	40703	40704	40705	40706 to 40736
9	40801	40802	40803	40804	40805	40806 to 40836
10	40901	40902	40903	40904	40905	40906 to 40936

Table 8. Query Poll Register

Allowed values for the Result register 40n05 (n = 0 to 9):

Value	Meaning
0	Success
1	Command not permitted
2	Inter process communication failure
67	Failure

Table 9. Query Poll Register Values

MODBUS CONFIGURATION

4.6.2 Query Types Available

Poll No	Description	Response Format
02	Read System Label	Unicode String – 35 (Unicode chars) + 1(null)
39	Read Alarm 1 level	Float (4 Bytes – 32 bit floating point)
40	Read Alarm 2 level	Float (4 Bytes – 32 bit floating point)
41	Read Alarm 3 level	Float (4 Bytes – 32 bit floating point)
42	Read STEL level	Float (4 Bytes – 32 bit floating point)
43	Read LTEL level	Float (4 Bytes – 32 bit floating point)
44	Read Rate level	Float (4 Bytes – 32 bit floating point)
102	Read Gas Name	Unicode String – 35 (Unicode chars) + 1(null)
103	Read Channel Tag Name	Unicode String – 35 (Unicode chars) + 1(null)
104	Read Gas Unit	Unicode String – 35 (Unicode chars) + 1(null)

Table 10. Query Type Descriptions

Query Poll Example: 'Query Type: Read Alarm 1 level':

Register	Block Active (40n01)	Channel Type (40n02)	Channel ID (40n03)	Query Type (40n04)	Result (40n05)	Result String (40n06 to 40n36)
Value	1	105	2	39	(Updated upon request execution)	(Updated upon request execution)

Table 11. Query Poll Example

If Block Active is set to 1, the Controller processes the request. If Block Active is set to 0 the Controller will not process the request or has already processed the request.

The sole option for 'Channel Type' is 105 – Input Channel.

4.7 Modbus RTU Command Types

Note: Due to a system limitation, TPPL will give an error message '**Command not permitted**' during Administrator or Service log on, but not when accessed by an Operator or User.

Command Type	Description
23	Alarm Acknowledge
24	Alarm Reset
25	Set Inhibit
26	Clear inhibit

Table 12. Command Types

MODBUS CONFIGURATION

Example: Alarm Acknowledge (Command Type):

Register	Block Active (41n01)	Channel Type (41n02)	Channel ID (41n03)	Command Type (41n04)	Command Data (41n05)	Result (41n06)
Value	1	105	2	23	0	(Updated upon request execution)

Table 13. Command Type Example

If 'Block Active' is set to 1, the Controller processes the request, but if 'Block Active' is set to 0 the Controller will not process the request or has already processed the request.

4.7.1 Modbus RTU Command Poll Registers

The sole option for Channel Type is 105 – Input Channel.

Note: Function 06/16 cannot be used for SIL channels.

Command Poll Block	Block Active	Channel Type	Channel ID	Command Type	Command Data	Result
1	41001	41002	41003	41004	41005	41006
2	41101	41102	41103	41104	41105	41106
3	41201	41202	41203	41204	41205	41206
4	41301	41302	41303	41304	41305	41306
5	41401	41402	41403	41404	41405	41406
6	41501	41502	41503	41504	41505	41506
7	41601	41602	41603	41604	41605	41606
8	41701	41702	41703	41704	41705	41706
9	41801	41802	41803	41804	41805	41806
10	41901	41902	41903	41904	41905	41906

Table 14. Modbus RTU Command Poll Registers

Allowed values for the Result register 41n05 (n = 0 to 9):

Value	Meaning
0	Success
1	Command not permitted
2	Inter process communication failure
67	Failure

Table 15. Modbus RTU Command Poll Register Values

MODBUS CONFIGURATION

4.8 Exception Responses

The Modbus exception response is detailed in the *Modicon Modbus Protocol Reference Guide*. Any one of the following exception responses may be returned by the Touchpoint Pro Modbus interface:

Exception	Description
01 ILLEGAL FUNCTION	Only Modbus functions 02, 03, 04 and 06 are supported. This response is returned if any other requests are received.
02 ILLEGAL DATA ADDRESS	The register addresses supported by each function are listed in this chapter. Any attempt to access a register outside of these ranges will result in this error.
03 ILLEGAL DATA VALUE	This exception is returned if the request has the incorrect length, or if the maximum number of registers is exceeded. The maximum number of registers that can be requested by function 02 is 512, function 04 is 64, and function 03 is 36 for the Query poll block or 6 for the Command poll block.
06 SLAVE DEVICE BUSY	Applies to function 06 only. Once a poll or command block's active register has been set, its contents must not be changed until the main program has carried out the request. This exception is returned if any attempt is made to change an active poll or command block.

Table 16. Modbus Exception Responses

Find out more at
www.honeywellanalytics.com

Contact Honeywell Analytics:

Europe, Middle East, Africa

Life Safety Distribution GmbH
Javastrasse 2
8604 Hegnau
Switzerland
Tel: +41 (0)44 943 4300
Fax: +41 (0)44 943 4398
gasdetection@honeywell.com

Customer Service:

Tel: 00800 333 222 44 (Freephone number)
Tel: +41 44 943 4380 (Alternative number)
Fax: 00800 333 222 55
Middle East Tel: +971 4 450 5800 (Fixed Gas Detection)
Middle East Tel: +971 4 450 5852 (Portable Gas Detection)

Americas

Honeywell Analytics Inc.
405 Barclay Blvd.
Lincolnshire, IL 60069
USA
Tel: +1 847 955 8200
Toll free: +1 800 538 0363
Fax: +1 847 955 8210
detectgas@honeywell.com

Asia Pacific

Honeywell Analytics Asia Pacific
7F SangAm IT Tower,
434 Worldcup Buk-ro, Mapo-gu,
Seoul 03922, Zuid-Korea
Korea
Tel: +82 (0)2 6909 0300
Fax: +82 (0)2 2025 0328
India Tel: +91 124 4752700
analytics.ap@honeywell.com

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Technical Services

EMEA: HAexpert@honeywell.com
US: ha.us.service@honeywell.com
AP: ha.ap.service@honeywell.com

www.honeywell.com

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