Title

HUBBUS

REMOTE ISOLATION INDICATOR

TYPE HBRII

USER MANUAL

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1 Introduction

1.1 BACKGROUND AND CONTEXT

HubBus is Austdac's long distance distributed I/O system used in a wide range of applications in non-hazardous environments. HubBus overcomes the limitations of other distributed I/O systems in terms of noise immunity from new variable frequency drives, number of channels for input and output devices, transmission distances on large overland conveyors and powering devices from the communications line.

1.2 PURPOSE

This document is the user's manual for the HubBus Remote Isolation Indicator (HBRII). It provides an overview and a detailed description of the installation, use and operation of the HubBus Remote Isolation Indicator.

This document does not contain detailed information concerning the operation of the HubBus system. Refer to the "HubBus System Description and Overview" user's manual (125-250-12) for detailed information on HubBus. Likewise, refer to the HubBus Safety Manual (125-NNN-12) for any functional safety related specifications.

2 Warnings and Precautions

2.1 WARNINGS

WARNING: The HubBus Signal -ve line must not be tied to any common, 0V, ground or Earth points.

WARNING: Do not use the same power supply as the channel generator. Any other modules or equipment must be galvanically isolated from the HubBus channel generators power source.

WARNING: The HubBus power source "SW1" switch above the configuration port connector MUST be in the RIGHT.

WARNING: If the HBRII is used in a manner not specified by Austdac then the protection provided by the HBRII may be impaired.

WARNING: This product may contain chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

2.2 SYMBOLS

Markings that may be used across the HubBus range of products to indicate precautions that must be taken to maintain safe operation of the system.

	Direct Current (DC) Supply
	Earth (ground) Terminal
	Caution, possibility of electric shock
	Caution (refer to user manual)

2.3 PRECAUTIONS

- Only qualified personnel shall install and service the HBRII.
- Mains supply fluctuations are not to exceed ±10% of the nominal supply voltage.

2.3.1 USER ACCESS

There are no user serviceable parts within the HBRII. The user should not open or disassemble the HBRII.

2.3.2 STORAGE, INSTALLATION, USE AND MAINTAINANCE REQUIREMENTS

The HBRII should only be installed, operated and maintained by qualified personnel in accordance with the condition of safe use as outlined in the certificate.

Ensure that all instructions and warnings are observed.

2.3.2.1 Storage

The specified storage temperature must be maintained during storage.

2.3.2.2 Installation and conditions of use

Prior to installation the HBRII should be inspected for the following;

- Any external damage to the enclosure.

The HBRII may be installed in any orientation.

The HBRII must be installed in a suitably certified IP54 or better enclosure or as required by legislation. The enclosure should provide adequate protection, from impact and ingress of dust and water.

The HBRII should be mounted to a stable surface avoiding areas under constant vibration and shock.

3 Overview

3.1 GENERAL DESCRIPTION

HubBus four channel remote isolation indicator. The HBRII is used to provide a visual indication under HubBus control. The HBRII can control up to 4 indicators and is designed to be used with the multicolour sunlight readable LED indicator Type IND1. The HBRII can receive from just a few through (from 1) to many digital (up to 2048) signals (ON, OFF or FAULT) from a HubBus network to control the four indicator outputs directly or via complex multi-term logic functions.

Figure 1: HubBus four channel Remote Isolation Indicator

The digital receiver has four indicator drivers controlled by up to six logic resolvers capable of implementing OR, AND, NOR and NAND logic functions. Each resolver has an independently configurable output ON and OFF delay filter to allow implementation of simple timer functions.

For safety each indicator output uses multiple points to activate driver circuity so that a failure in any part of the driver circuit will lead to the driver output failing to the safe mode (de-energised state). Additionally, the current consumption of the indicators is also monitored to detect other failure modes like missing or open circuit indicators and short circuits.

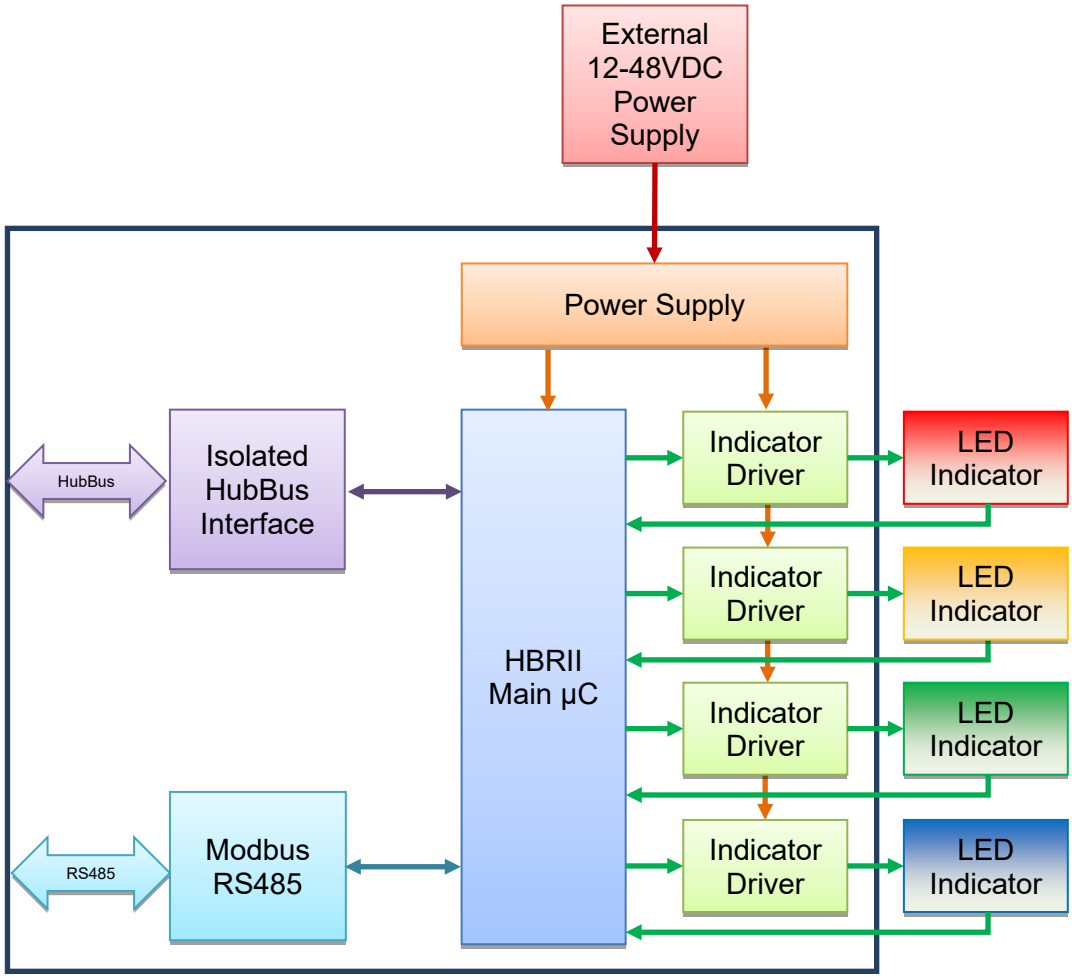


Figure 2: HubBus four channel Remote Isolation Indicator block diagram

3.2 OPERATION

3.2.1 Fault Monitoring and Prevention

The HBRII has advanced firmware and hardware features for increased safety and reliability in preventing an undesired state of the indicator outputs.

The indicators drivers are enabled by signals driven by firmware at multiple points only if all internal diagnostics indicate that the hardware is in correct working order. In addition to this the HBRII monitors current consumption to each indicator which is used to determine the current state of the indicator outputs. If a fault is detected and the indicators are potentially in a 'stuck-on' state then a fault alarm is transmitted on the HubBus network for another unit to shut-down the system under control so that it may be rendered in a "safe state".

3.2.2 Logic Resolvers

The HBRII digital receiver has six configurable multi-term logic resolvers of which four drive indicator outputs. These logic resolvers are typically used to implement

functions for emergency stop or remote isolation. The available basic logic functions are ‘OR’, ‘AND’, ‘NAND’ and ‘NOR’.

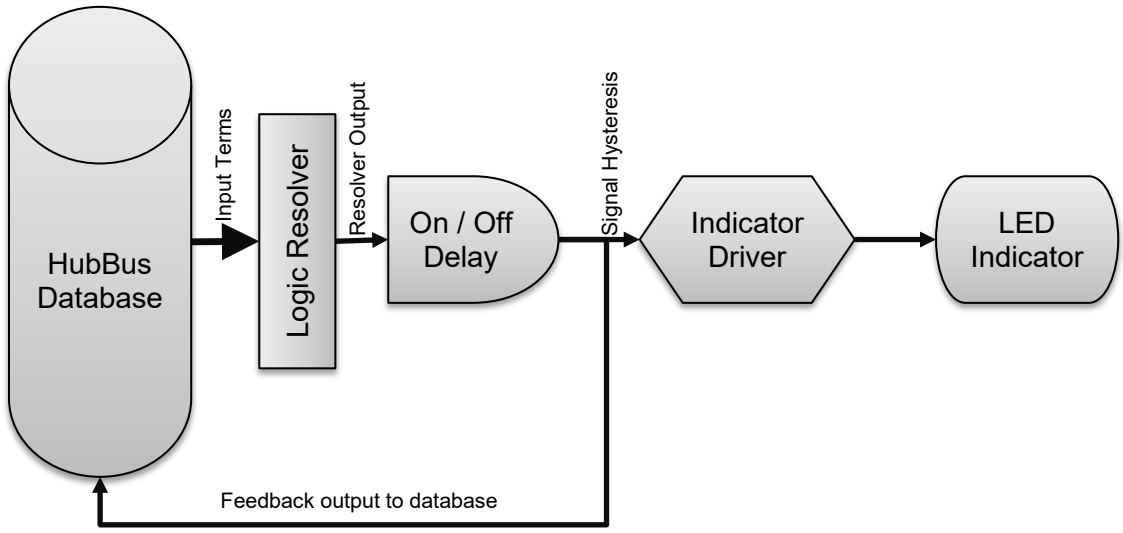


Figure 3 Multi-term logic layout and function

Each logic resolver may use the maximum number of input terms equal to the maximum number of HubBus channels (i.e. 2048). The input terms for each channel may be specified as ‘ON’, ‘OFF’ or ‘FAULT’. Channels assigned for Datalink (multi-channel transmission) should not be used as input terms of the logic functions as unpredictable results will be obtained.

The output of the logic resolver may have hysteresis or delay applied before being applied to the relay or HubBus output. The on and off filter times may be independently configured from 100ms to minutes in 100ms steps. These delays are used to stop intermittent signals from causing inadvertent trips and alarms. The filter on time ensures that the output from the logic resolver must be on for the ‘on’ filter period before the relay output will be asserted. The filter off time ensures that the output from the logic resolver must be off for the ‘off’ filter period before the relay output will be negated.

The filtered logic resolver output may also be sent back onto the HubBus channel database for transmission and use in further logic operations or to be read via the MODBUS interface.

If the relay output is required to be operated from a single HubBus channel then a single-term ‘AND’ or ‘OR’ logic function should be implemented.

When logic resolver outputs are fed back into the HubBus channel database the designer should ensure that these feedback channels are not modified by other field devices or via the MODBUS interface.

4 Installation

4.1 ENCLOSURE

The HBRII should be mounted in a host enclosure providing protection against dust and moisture. A minimum ingress protection of IP54 is recommended.

4.2 MOUNTING

The HBRII should be mounted on an NS 35 DIN rail.

Optionally, a 16-position DIN rail connector can be inserted in the DIN rail. This serves to establish automatic contact from device to device. The bus connector carries HubBus, Modbus and power.

4.3 TERMINALS

All connections to the HBRII are via push-in spring terminal with tension sleeve around the base of the DIN rail mounting enclosure.

- Maximum cross section of solid core conductor: 2.5mm^2
- Maximum cross section of stranded conductor with ferrule: 2.5mm^2
- Minimum cross section of solid core conductor: 0.2mm^2
- Minimum cross section of stranded conductor with ferrule: 0.25mm^2

5 Front Panel

5.1 OUTER

As viewed with the top cover in place.

Figure 4: Front panel

5.1.1 LEDS

LED indicators give a quick overview of current system operational state.

5.1.1.1 STAT

Colour	Flash Rate	Description
GREEN	Flash	Communication to HubBus interface active and sync pulse detected.
RED	Solid	Lost communication to HubBus interface.

Table 1: STAT LED

5.1.1.2 SYNC

Colour	Flash	Description

	Rate	
YELLOW	Single	HubBus Sync pulse detected. Driven by the HubBus interface.
	Double	HubBus interface board lost communication to main module. Check line power switch.

Table 2: SYNC LED

5.1.1.3 +V

Colour	Flash Rate	Description
GREEN	Solid	External power source good.

Table 3: +V LED

5.1.1.4 Rx

Colour	Flash Rate	Description
BLUE	Flash	MODBUS Receive, persistence of 100ms

Table 4: Rx LED

5.1.1.5 Tx

Colour	Flash Rate	Description
BLUE	Flash	MODBUS Transmit, persistence of 100ms

Table 5: Tx LED

5.1.1.6 (1)

Colour	Flash Rate	Description
YELLOW	Solid	Indicator 1 energised
YELLOW	Fast	Indicator 1 fault detected

Table 6: (1) LED

5.1.1.7 (2)

Colour	Flash Rate	Description
YELLOW	Solid	Indicator 2 energised
YELLOW	Fast	Indicator 2 fault detected

Table 7: (2) LED

5.1.1.8 (3)

Colour	Flash Rate	Description
YELLOW	Solid	Indicator 3 energised
YELLOW	Fast	Indicator 3 fault detected

Table 8: (3) LED

5.1.1.9 (4)

Colour	Flash Rate	Description
YELLOW	Solid	Indicator 4 energised
YELLOW	Fast	Indicator 4 fault detected

Table 9: (4) LED

5.2 INNER

Module display board as viewed with the housing top cover opened.

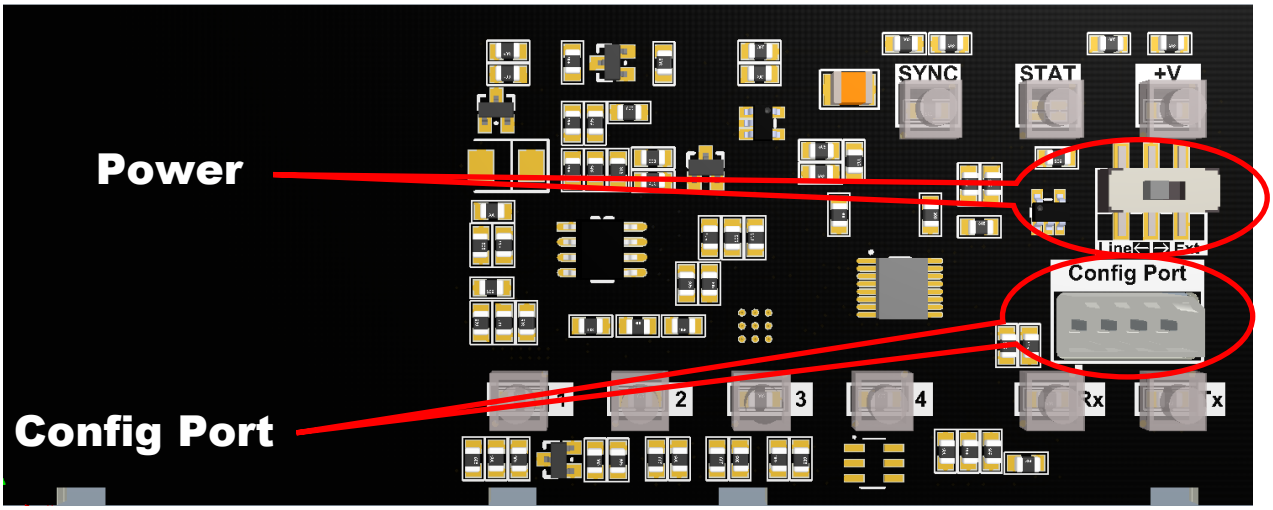


Figure 5: Display and interface board

5.2.1 Power Source Selection

Power source selection:

A. HubBus line powered

B. External power supply

This switch is not applicable or functional on the HBRII as it must be powered from an external power supply. It is not capable of being line powered.

5.2.2 Config Port

Four pin TTL level configuration port. This has the HubBus Modbus interface. Using this port disables the watchdog (monitor) and the RS485 port.

6 Terminals

6.1 TYPE

The PCB terminal connector is a Phoenix Contact style with 5.08mm pitch. Austdac supplies the module with a 90˚ free hanging push-in spring terminal plug.

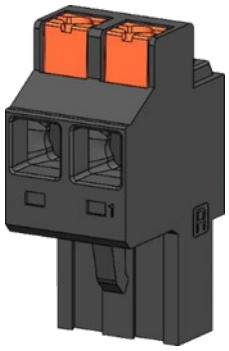


Figure 6: Terminal Plug

6.2 LAYOUT

HBRII					
13	+	Output 1	HubBus	Signal+	1
14	-			Signal-	2
16	+	Output 2			
17	-				
19	+	Output 3	Modbus RS485	A+	7
20	-			B-	8
				COM	9
22	+	Output 4	N/A		10
23	-		Power Input	+V	11
				0V	12

Table 10: HBRII Terminals

6.2.1 Power

Any industrial rated power supply may be used. Other modules (except for the channel generator) or equipment may be supplied from the same source.

Operating Range: 10-48VDC

Recommended: 24VDC @ 5A (Omron S8VK-G24024)

6.2.2 HubBus

HubBus terminals for interfacing to the HubBus network. This port is electrically isolated from all the other terminals on the HBRII module.

WARNING: The HubBus Signal –ve line must not be tied to any common, 0V, ground or Earth points.

6.2.3 MODBUS

This is an RS485 MODBUS port at 19,200bps used for configuration. The HBRII is considered a slave device on the MODBUS network and therefore must be interrogated by a master device. Refer to the configuration section of this manual for instructions on setting network addresses etc.

Port is disabled when the front panel configuration port is active.

This port is galvanically isolated from the HubBus network.

6.2.4 DIN Rail Bus

To eliminate inter-module wiring a DIN-rail bus system may be used with the HubBus modules. The DIN rail bus is used to distribute the following:

- HubBus module auxiliary power (10-48VDC)
- RS485 MODBUS
- HubBus Signal

6.2.5 Indicator Output Terminals (1 to 4)

This output is designed to be used with Austdac's multicolour sunlight readable LED indicator Type IND1. Control logic may be configured with 1 to many HubBus channels using 'OR' or 'AND' logic.

Maximum output current from each port is 40mA. Brightness levels (maximum current outputs) are configurable and the user must ensure that the LED indicators are not subjected to levels beyond their design limits.

The status of the indicator output is also available as a front panel LED indication, as a HubBus channel or as a MODBUS status.

7 Configuration and Parameters

The following are descriptions of the system and device parameters. They may only be configured using the Austdac Hand-Held Programmer type HHP1-H. Refer to the “HHP1-H Handheld Programmer User Manual” (125-198-12) for further information.

7.1 CONFIGURATION PROCESS

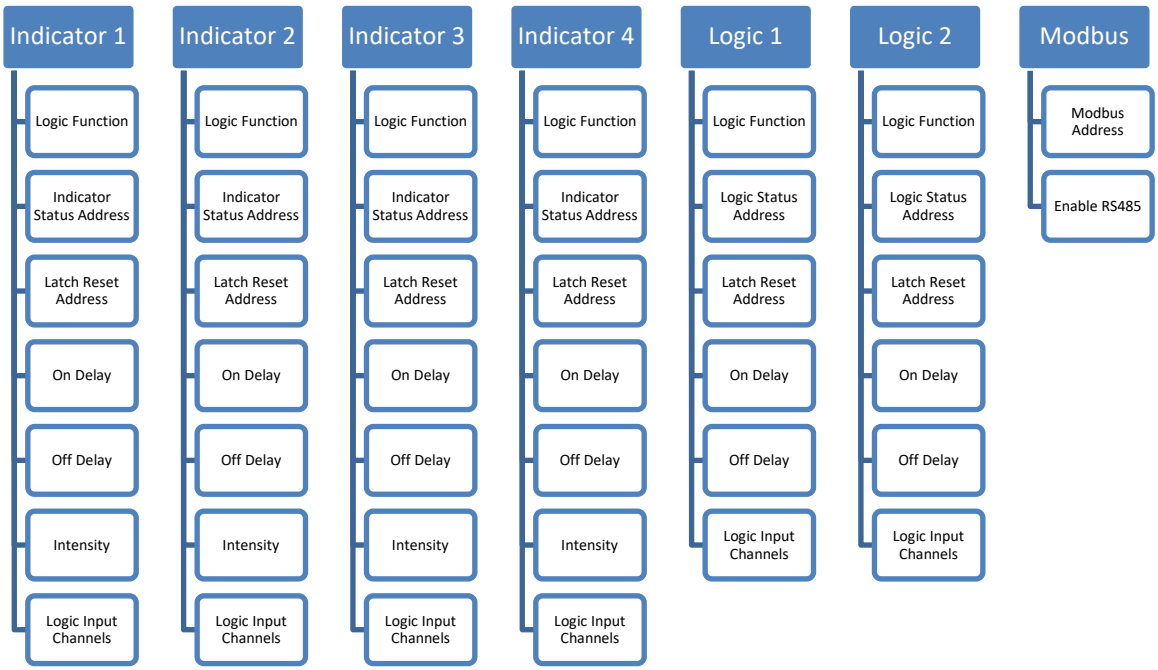
This unit may be used in a safety function. Only the Austdac Handheld programmer, type HHP1-H, may be used to configure the HubBus safety devices.

Configuration of safety devices follow the below process:

1. Enter the configuration option when the HHP1-H is connected to the device.
2. Scroll to the desired parameter to be modified.
3. The handheld will display the current value to the displayed parameter.
4. Press [ENTER] key to modify the parameter
5. Modify the parameter to the desired value.
    a. Press [MENU] to cancel and revert to the previous configured value.
    b. Press [ENTER] to accept the new value and send to device.
6. The value will be checked by the handheld and the device. If there are any problems an error message will be displayed on the handheld indicating the type of problem.
7. The new parameter value will be sent back to the handheld for visual confirmation by the user.
8. The user will be prompted to:
    a. Save the value by pressing the [ENTER] key, or
    b. Revert back to the original value by pressing the [MENU] key
9. The handheld will now display the parameter value as store in non-volatile memory in the device.

Note:	**Prior to disconnecting the handheld programmer, the user should verify all safety parameters are correct and document any changes made. Before restarting the system after making changes to safety parameters the safety functions must be validated.**

7.2 PARAMETER SUMMARY



7.2.1 Indicator Parameters

The following describes the parameters available for each of the four physical indicator outputs and the two virtual logic resolvers.

7.2.1.1 Logic Function

Logic function associate with each logic resolver.

Default	Value
Yes	Disabled
	AND
	OR
	NAND
	NOR

Table 11: Parameter – Logic Function

7.2.1.2 Indicator Output (Logic) HubBus Output Address

Feedback or returned value from the logic resolver to be transmitted by the HBRII and/or used as input to other logic functions.

Limit	Value (channels)
Minimum	0 (Disabled)
Maximum	2048
Default	Disabled

Table 12: Parameter – HubBus Output Address

7.2.1.3 Latch Reset Address

If enabled with a HubBus address, the relay will not re-energise after a trip or restart until it has seen a transition from OFF (0) to ON (1) on the configured HubBus channel. All input logic must be in a state that will allow for energisation of the output and then only after the transition of the latch reset channel from OFF-to-ON, will the output be energised.

Limit	Value (channels)
Minimum	0 (Disabled)
Maximum	2048
Default	Disabled

Table 13: Parameter – HubBus Latch Reset Address

7.2.1.4 On Delay

The OFF-to-ON hysteresis (or persistence delay) period for the given logic resolver. The delay can be assigned a value from 0.1 seconds through to 300 seconds (5 minutes). The functional logic has to be true for this period before the state is applied to the relay and/or HubBus output channel as selected in the previous section.

Limit	Value (seconds)
Minimum	0
Maximum	300
Step	0.1
Default	0

Table 14: Parameter – Logic On Delay

7.2.1.5 Off Delay

The ON-to-OFF hysteresis (or persistence delay) period for the given logic resolver. The delay can be assigned a value from 0.1 seconds through to 300 seconds (5 minutes). The functional logic has to be false for this period before the state is applied to the relay and/or HubBus output channel as selected in the previous section.

Limit	Value (seconds)
Minimum	0
Maximum	300
Step	0.1
Default	0

Table 15: Parameter – Logic Off Delay

7.2.1.6 Indicator Output Intensity

Output intensity of the LED indicator output. Expressed as a percentage of 0 through to 100 it determines the output drive current from 0 to 40mA.

Limit	Value (%)	Drive (mA)
Step	1	0.4
Minimum	0	0
Maximum	100	40
Default	50%	20

Table 16: Parameter – Indicator output intensity

7.2.1.7 Channels

The logic resolver may equate (have input defined for) up to 2048 channels. Each channel input may have one of 4 states defined as the input term.

- Ignore: Logic resolver ignores this channel when resolving the term.
- OFF: The digital input is in the 'off', inactivated or reset state.
- ON: The digital input is in the 'on', activated or locked-out state.
- Fault: The digital input is in the 'fault' state or not transmitting.

Parameter	Value	Description
Don't Care/Ignore	-	Not included in logic function
ON	1	Locked-out/Activated
OFF	0	Reset
Fault/Missing	X	Fault state

Table 17: Parameter – Channel Logic Values

7.2.1.8 Examples

The following are some basic logic function examples.

Example 1

- Channels 10, 20, 30, 40 and 50 all ON.
- Logic Function: AND
- Logic term: 10(ON).20(ON).30(ON).40(ON).50(ON)

Example 2

- Channels 10, 20, 30, 40 all ON and 50 OFF.
- Logic Function: AND
- Logic term: 10(ON).20(ON).30(ON).40(ON).50(OFF)

Example 3

- Channels Any of 10, 20, 30, 40 or 50 are ON.
- Logic Function: OR
- Logic term: 10(ON)+20(ON)+30(ON)+40(ON)+50(ON)

Example 4

- Channels Any of 10, 20, 30 or 40 are ON or 50 is OFF.
- Logic Function: OR
- Logic term: 10(ON)+20(ON)+30(ON)+40(ON)+50(OFF)

7.2.2 Modbus Parameters

These are the Modbus parameters.

7.2.2.1 Modbus Address

Modbus address parameter, care must be taken not to have multiple devices with the same address on the bus.

Limit	Value (seconds)
Minimum	1
Maximum	247
Step	1
Default	10

Table 18: Parameter – Modbus Address

7.2.2.2 RS485 Enable

This should only be enabled when the unit is not being used for a safety function. It enables the Modbus RS485 port on the terminal connector and DIN rail bus.

Value	Meaning
Enabled	Port enabled
Disabled	Port disabled
Default	Disabled

Table 19: Parameter – RS485 Enable

8 MODBUS

8.1 PHYSICAL LAYER

Mode:	[Terminals] 2-wire RS485
	[Configuration Port] TTL
Protocol:	Modbus RTU
Baud Rate:	19200
Data Bits:	8
Stop Bits:	1
Parity:	Even
Address:	10

8.2 MODBUS REGISTERS

Register Limits:

- Code 1 / Read Coils: 256 bits
- Code 2 / Read Discrete Input: 256 bits
- Code 3 / Read Holding Registers: 64 words
- Code 4 / Read Input Registers: 64 words
- Code 15 / Write Multiple Coils: 256 bits
- Code 16 / Write Multiple Registers: 64 words

Modbus Address: 10

Message delay: 10ms

8.2.1 Device Identification

Type: Holding Registers

Register Name	Start Address	Number of registers	Read / Write	Description
Module Name	1024	4	R	“HBRII”
Module Identifier	1028	4	R	N/A, returns “”
Austdac Serial No.	1032	4	R	Austdac format serial number in the following format: “YYMMnnnn”
F/W Ver. Main	1036	1	R	Firmware version of the main microcontroller, most significant byte is the major and the least significant byte is the minor version number.
F/W CRC Main	1037	1	R	Returns 16-bit CRC signature of main firmware.
F/W Ver. Sub-ass.1	1038	1	R	Firmware version of the HubBus interface and display board, most significant byte is the major and the least significant byte is the minor version number.
F/W CRC Sub-ass.1	1039	1	R	Returns 16-bit CRC signature of the HubBus interface and display board.
F/W Ver. Sub-ass.2	1040	1	R	N/A, returns 0.0
F/W CRC Sub-ass.2	1041	1	R	N/A, returns 0
F/W Ver. Sub-ass.3	1042	1	R	N/A, returns 0.0
F/W CRC Sub-ass.3	1043	1	R	N/A, returns 0
Unique ID Main	1044	4	R	Unique identifier (64 bit). Comes from 1-wire device.
Unique ID Sub-ass.1	1048	4	R	N/A, returns 0
Unique ID Sub-ass.2	1052	4	R	N/A, returns 0
Unique ID Sub-ass.3	1056	4	R	N/A, returns 0
Protocol Version	1060	1	R	HubBus MODBUS configuration protocol version.

Table 20: Modbus Registers – Device identifier

8.2.2 Information

These are the MODBUS registers for direct access to the given information data.

Type: Holding Registers

Register Name	Data Address	Number of registers	Read / Write	Type	Volatile	High	Scale	Description
Indicator 1 Output Status	1065	1	R	U16	Y	1	1	Indicator 1 State: 0 = De-energised 1 = Energised 2 = Drive Fault 4 = Logic Fault
Indicator 2 Output Status	1066	1	R	U16	Y	1	1	

Indicator 3 Output Status	1067	1	R	U16	Y	1	1	
Indicator 4 Output Status	1068	1	R	U16	Y	1	1	
Logic 1 Output Status	1073	1	R	U16	Y	1	1	
Logic 2 Output Status	1074	1	R	U16	Y	1	1	
Indicator 1 Current	1069	1	R	U16	Y	1	1	Indicator 1 current (mA)
Indicator 2 Current	1070	1	R	U16	Y	1	1	Indicator 2 current (mA)
Indicator 3 Current	1071	1	R	U16	Y	1	1	Indicator 3 current (mA)
Indicator 4 Current	1072	1	R	U16	Y	1	1	Indicator 4 current (mA)
External Power	1075	1	R	U16	Y	1	1	External line power
+3V3	1076	1	R	U16	Y	1	1	3v3 rail
+3V6	1077	1	R	U16	Y	1	1	3v6 rail

Table 21: Modbus Registers – Information Data

Displayed value = (DATA / HIGH) * SCALE

8.2.3 HubBus Digital

N/A

8.2.4 HubBus Datalink

N/A

9 Specifications

General	
Name	HubBus Remote Isolation Indicator
Type	HBRII
Interface	
Number of HubBus terminals	1
Bus channels	Adaptive (up to 2048)
Bus protocol	Dual pulse alternating on cycles
Bus connection	Galvanically Isolated
RS485	1 x Modbus 2 wire (isolated port)
Configuration	TTL, 19,2k/8/1/E
Physical	
Dimensions	72mm (W) x 63mm (D) x 90mm (H)
Mass	150g
Mounting	DIN EN 60715 / TS35
Ingress protection	IP20
Enclosure material	PC (Polycarbonate) V0 (UL94)
Enclosure colour	RAL 7032 Grey / RAL 9005 Black
Terminals	
Terminals	90˚ free hanging push-in spring terminal plug
Terminal Cross Section	2.5mm^2
Terminal Pitch	5.08mm
Terminal Material	PA V0 (UL94)
Terminal Colour	Black
Environment	
Operating Temperature	-20ºC to 50ºC
Storage Temperature	-20ºC to 80ºC
Humidity	80% to temps. up to 31ºC decreasing linearly to 50%rH at 40ºC max 80% rH, non-condensing
Pollution Degree	2
Installation Category	1
Altitude	2000m
Electrical	
Bus voltage	12 to 48VDC (p-p)
Unit load	1
Bus current consumption	5mA maximum @ 12-48VDC
Bus speed	Auto configurable (1.2ms to 4.8ms/pulse)
Power supply voltage	12 to 48VDC
Power supply current consumption	100mA maximum @ 12VDC 100mA maximum @ 24VDC 100mA maximum @ 48VDC
Status	
Modbus Activity	2 front panel LED
Controller healthy indication	1 front panel LED
Power healthy indication	1 front panel LED
Bus healthy indication	1 front panel LED
Relay Status	4 front panel LED
Logic Resolver	
Number	4 with Indicator and HubBus output + 2 with HubBus output
Logic Functions	AND, OR, NAND and NOR
Channel Terms	N/A, ON, OFF or FAULT
Indicator Driver	
Current Output	Adjustable: 0 to 40mA
Fault Detection	Open circuit, under and over current detection

Table 22: Specifications