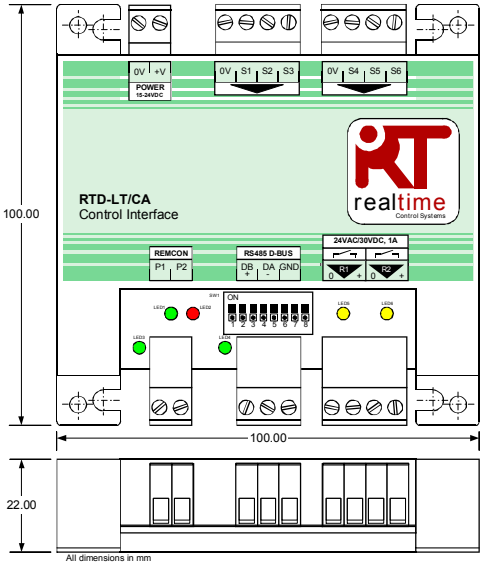
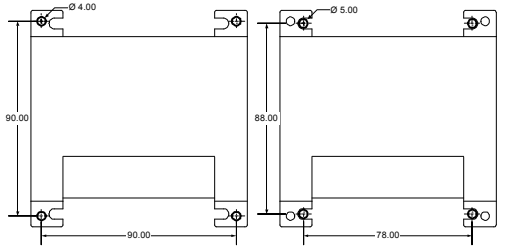
RTD-LT/CA

Installation Instructions

English RTD-LT/CA Installation Instructions



realtime
Control Systems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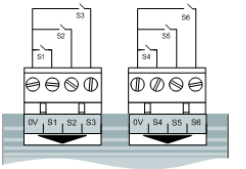
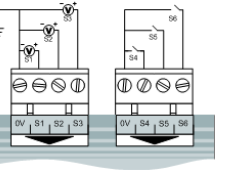
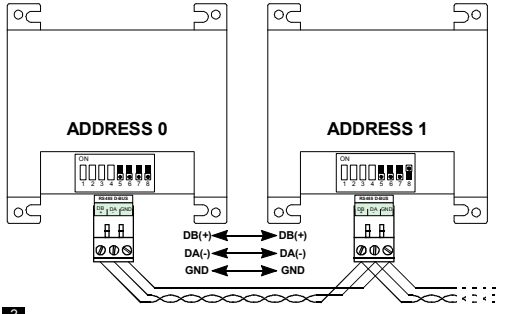

S3
S2
S1
S6
S5
S4
0V
S1
S2
S3
0V
S4
S5
S6

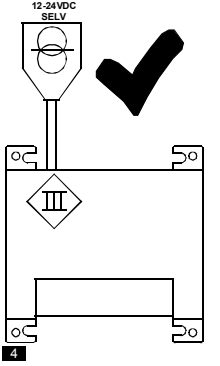
3a


S3
S2
S1
S6
S5
S4
0V
S1
S2
S3
0V
S4
S5
S6

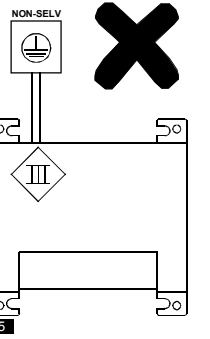
3b


ADDRESS 0
ADDRESS 1
ON
1 2 3 4 5 6 7 8
RS485 D-BUS
DB
DA
GND
DB(+)
DB(+)
DA(-)
DA(-)
GND
GND

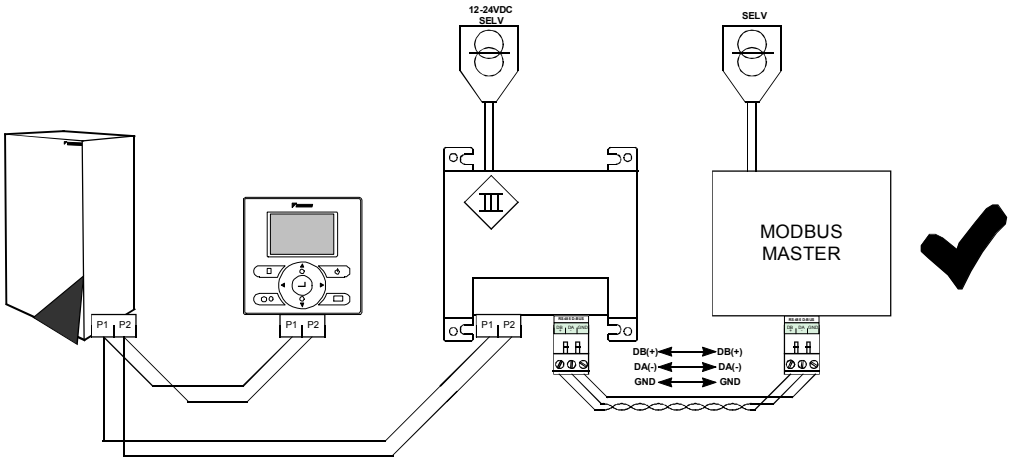
2


12-24VDC
SELV

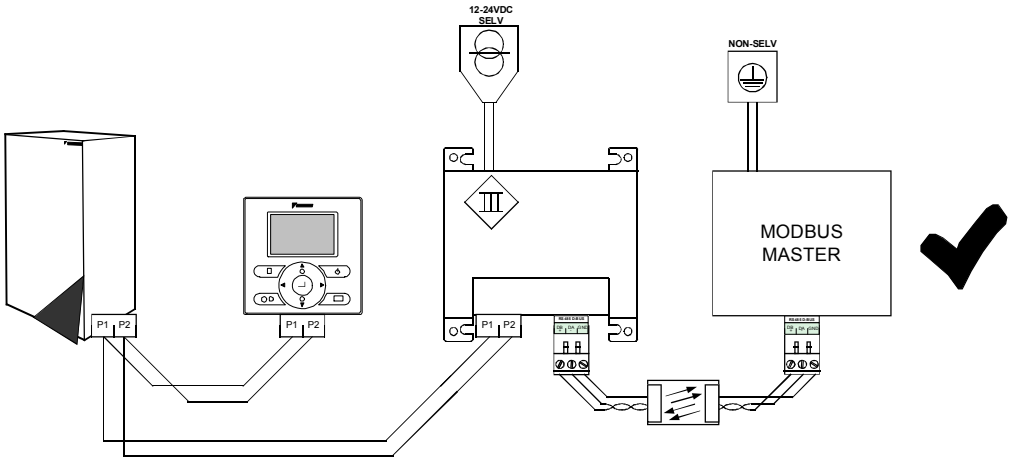
4


NON-SELV

5


12-24VDC
SELV
SELV
MODBUS
MASTER
P1
P2
P1
P2
P1
P2
DB(+)
DA(-)
GND
DB(+)
DA(-)
GND

6



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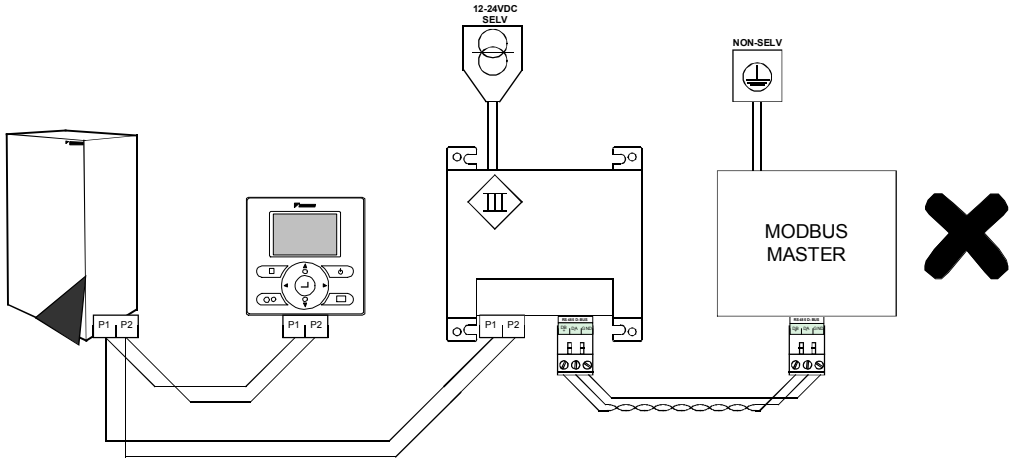
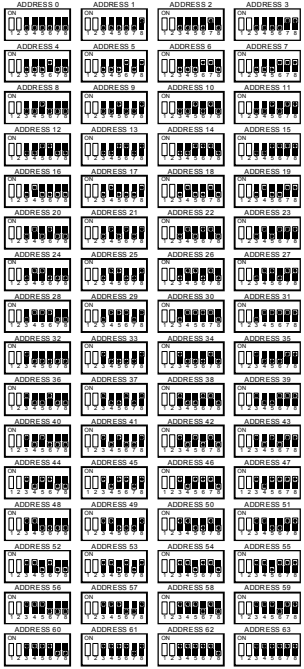


8


ADDRESS 0
ADDRESS 1
ADDRESS 2
ADDRESS 3
ADDRESS 4
ADDRESS 5
ADDRESS 6
ADDRESS 7
ADDRESS 8
ADDRESS 9
ADDRESS 10
ADDRESS 11
ADDRESS 12
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ADDRESS 14
ADDRESS 15
ADDRESS 16
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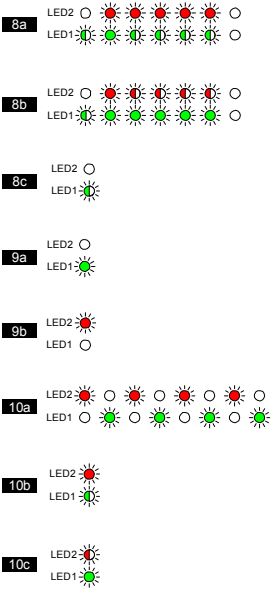
ADDRESS 60
ADDRESS 61
ADDRESS 62
ADDRESS 63
ON

9


8a
LED2
LED1
8b
LED2
LED1
8c
LED2
LED1
9a
LED2
LED1
9b
LED2
LED1
10a
LED2
LED1
10b
LED2
LED1
10c
LED2
LED1

⚠ Warnings and Cautions

Do not exceed the specified fault relay ratings (maximum 1A, 24VAC/30VDC). Relays not intended for connection to safety critical equipment.

All cable connections to the device and the indoor unit must be adequately secured by suitable strain relief fasteners.

The RTD must either be mounted in a suitable metal enclosure or plastic enclosure with a flammability rating of at least IEC60695-11-10 V-1. Do not install it inside the Altherma unit. In all cases access by non-qualified persons must be prevented (the enclosure may not accessible without a tool). The unit can be mounted horizontally or vertically.

The RTD must be powered from an SELV power supply (Figure 4, 5). Any device connected to the RTD on the RS485 connection must also be powered from an SELV power-supply (Figure 6), or must be connected via a galvanic isolated RS485 repeater with at least 1.25kV isolation (Figure 7). Non-SELV devices must not be connected directly to the RTD (Figure 8).

RS485 Cables must use stranded 24awg shielded or unshielded twisted pair to Cat3, Cat4 or Cat5 specification. Use a twisted pair for connections DB,DA and an extra core for connection GND. Install RS485 cable as shown in Figure 2.

The P1,P2 Network must be connected as shown in Figure 6.

When connecting a voltage signal from external sources to an RTD input, the voltage source must be SELV and the 0V line must be connected to earth external to the RTD.

S1 to S6 cables must be 0.5 to 0.75 mm^2 multi-stranded screened twisted pair. The screen must be earthed at one end only. The maximum distance from the RTD to the input source is 200m.

Specifications

Electrical	
Supply	15V-24V DC, 120mA Regulated SELV
Power	<2.5VA
Relay	1A, 24VAC max 1A, 30VDC max
Connectors	Rising clamp to 0.75mm^2 cable

Environmental	
Temperature	
Storage	-10oC to 50oC
Operation	0oC to 50oC
Humidity	0-90% RH non-condensing

Network	
P1P2	<1m
RS485	<500m

Inputs	
Voltage Mode	S1..S6 0..10VDC SELV, <1mA Maximum Rating 12VDC
Resistance Mode	S1..S6 5V, 1mA Pulse Maximum 10Hz

Your product is marked with the symbol shown to the left. This symbol on the product indicates that this product must not be disposed of with your other household waste. Inappropriate disposal may be harmful. Instead, it is your responsibility to dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. Units must be treated at a specialized treatment facility for re-use, recycling and recovery. By ensuring this product is disposed of correctly, you will help to prevent potential negative consequences for the environment and human health. Please contact the installer or local authority for more information.

Observe precautions for handling Electrostatic Sensitive Devices

Additional information, including Modbus configuration and Fault Codes are available from ***www.realtime-controls.co.uk/rtd***

Installation Instructions

The RTD-LT/CA is a monitoring and control interface for Heating Only and Heating and Cooling Altherma Split LT CA Series hydroboxes.

MOUNTING (FIGURE 1)

The RTD-LT/CA can be mounted using screws of up to 5mm diameter.

POWER SUPPLY (FIGURE 4,5,6,7,8)

The RTD requires a 15V to 24VDC power connection, the power supply must be SELV (Safety extra low voltage) : power supply below 42V supplied through a safety isolating transformer complying with EN61558-2-6.

P1,P2 NETWORK (FIGURE 6)

Terminals P1, P2 connect to the P1, P2 network. P1,P2 installation must follow installation specifications. The RTD-LT/CA operates in SUB mode with a EKRUCAL1 remote controller configured as MAIN.

See Altherma LT CA instructions for number of controllers that can be connected to P1P2, the RTD counts for 1 BRC controller.

RS485 NETWORK INSTALLATION (FIGURE 2)

The RS485 D-Bus network requires a twisted pair cable connecting terminals DB(+) and DA(-) on each device as shown in Figure 2. Terminal DB must be connected to all other DB terminals. Terminal DA must be connected to all other DA terminals. In addition the common terminal GND on all devices must be connected together. If a shielded cable is used then the shield can be used for this purpose. It is recommended that the GND connection is connected to local Earth at one point only. The network must be installed as a daisy-chained point-to-point Bus configuration, Star and Ring connections must NOT be used. All devices connected to the RTD via the RS485 network must be powered from an SELV power supply, or the RS485 must be isolated by a galvanic isolation RS485 repeater.

RS485 NETWORK LENGTH

Standard installation for total network distances of up to 500m can be achieved following the basic daisy-chaining method showed in the above diagram. The network can be extended further using RS485 repeaters.

LED FUNCTIONALITY

When the RTD-LT/CA is powered up, or if it loses communication with the Remote Controller the RTD-LT/CA enters P1,P2 search mode. If P1,P2 communications are not re-established after 1 minute the RTD-LT/CA will raise an alarm which will be indicated on the fault relay output. LED behaviour is shown in the following figures

Power-Up sequence: Factory Configuration	Figure 8a
Power-Up sequence: Custom Configuration	Figure 8b
P1,P2 Search. After power-up and during unit configuration	Figure 8c
No Fault State	Figure 9a
Unit Fault	Figure 9b
Device configuration error	Figure 10a
AC Unit Missing (U5 Fault)	Figure 10b
RS485 Communications timeout	Figure 10c

LED Key:

○ OFF	☀ ON	☀ Flashing

ADDRESSING

The RTD-LT/CA has the facility to create control groups using multiple RTDs connected together on the RS485 D-Bus network. In standard configuration up to 64 RTD-LT/CA devices can be connected together. For Resistance Control, Voltage Control and Sequencer Mode each RTD is assigned a D-Bus address 0 to 63 using the configuration switches SW1.3 to SW1.8. (FIGURE 9). In Smart Grid Mode the RTD Address Range is 0 to 15 set using the configuration switches SW1.5 to SW1.8 for Address 0 to Address 15(Figure 9) .

UNIT SEARCH

When the RTD-LT/CA is powered up, or if it looses communication with the Remote Controller the RTD-LT/CA enters P1,P2 search mode. After establishing communications the RTD may take up to 8 minutes before entering normal operation with either LED1 or LED2 illuminated permanently. If P1,P2 communications fail and are not re-established after 1 minute the RTD-LT/CA will raise an alarm which will be indicated on the fault relay output.

STANDARD INPUTS

Inputs S1 to S6 are wired between the labelled sensor terminal and the 0V terminal on the same connector block (Figure 3a and 3b).

S1 to S6 cables must be 0.5 to 0.75mm^2 multi-stranded screened twisted pair. The screen must be earthed at one end only. The maximum distance from the RTD-LT/CA to the input source is 200m.

For Voltage Inputs the Power Supply for the source of the Voltage Signal must be SELV.

It is recommended that volt-free contacts or switch mechanisms have gold plated contacts to ensure a low resistance circuit when the switch is made.

SETPOINT LIMITS

Limits for LWT Heating/Cooling Setpoint and Tank Setpoint can be manually adjusted using the REMCON, see installation manual for instructions. Standard setpoint limits are in the following table.

Setpoint	Resistance kΩ	Voltage V	Setpoint °C
LWT Heating Minimum	4.5	4.5	25
LWT Heating Maximum	7.5	7.5	55
LWT Cooling Minimum	2.5	2.5	5
LWT Cooling Maximum	4.2	4.2	22
DHW Minimum	5.0	5.0	30
DHW Maximum	8.0	8.0	60

Table 1. Standard Setpoint Limits

INPUT RESISTANCE/VOLTAGE TO SETPOINT

Resistive input are accurate to 0.1kΩ, allowing a setpoint to be defined to the nearest 1°C. Table 2. gives the relationship between resistance and setpoint. For example a resistance of 5.3kΩ corresponds to a setpoint of 33°C. For switched inputs, OFF is R<0.5kΩ(Short Circuit). ON is R>200kΩ (Open Circuit). Setpoint can be set only within the limits defined in Table 1.

Resistance kΩ	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Setpoint °C	-10	0	10	20	30	40	50	60	70	80

Table 2. Input Resistance to Setpoint

Voltage inputs are accurate to 0.1V, allowing a setpoint to be defined

to the nearest 1°C. Table 3. gives the relationship between voltage and setpoint. For example a voltage of 5.3V corresponds to a setpoint of 33°C. For switched inputs, OFF is V<0.5V, ON is V>0.6..0.9V. (Open Circuit). Setpoint can be set only within the limits defined in Table 1.

Voltage V	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Setpoint °C	-10	0	10	20	30	40	50	60	70	80

Table 3. Input Voltage to Setpoint

REMOTE CONTROLLER LOCATION

The REMCON can be located either **At Unit** or **In Room** by setting [A.2.1.B]. For Room Thermostat control using the REMCON temperature sensor, configure [A.2.1.B] as **In Room**. If RTD Simulated Room Temperature (H0050) value greater than 0°C is written the REMCON will be automatically configured as **At Unit** by the RTD. If RTD is removed then REMCON must be manually set **In Room**.

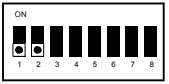
ADD ZONE SUPPORT

ADD Zone operation is activated by setting A.2.1.8 to '2 Zone', or field setting 7-02 to 1.

In cases where ADD Zone is used in Room Temperature Control mode, in Resistance and Voltage mode the Space Heating and Space Cooling On/Off commands on inputs S1 and S2 operate in the following manner: If LWT is OFF then an ON command on input S1 or S2 will cause Room Temperature control to be enabled in MAIN and ADD zone and LWT control will automatically switch ON. When an OFF command occurs on input S1 or input S2, MAIN zone Room Temperature Control will change to OFF, but ADD zone Room Temperature Control will remain ON so LWT control will remain ON. LWT Control can be switched OFF using the LWT ADD On/Off command on the REMCON home screen or using Modbus Command.

If switching of ADD Zone On/Off is required through a contact then an auxilliary contact can be connected to the ADD zone control terminals 1a and 4 of X2M on the Altherma CA indoor unit PCB.

RESISTANCE CONTROL



For Standard Control operation, SW1.1 and SW1.2 should be OFF.

Input	Name	Range (**default**)
S1	Space Heating On*	On Open Circuit: Heating OFF On Closed Circuit: Unit ON and Heat Mode On 1-10kΩ Heating ON and Set LWT Heating Setpoint
S2	Space Cooling On*	On Open Circuit: Cooling OFF On Closed Circuit: Unit ON and Cool Mode On 1-10kΩ Heating ON and Set LWT Cooling Setpoint
S3	DHW Tank On	On Open Circuit: DHW OFF On Closed Circuit: DHW ON On 1-10kΩ DHW ON and Set DHW Reheat Setpoint
S4	Enable Quiet Mode	**Open Circuit: Quiet Mode Disable** Closed Circuit: Quiet Mode Enable
S5	Heating Interlock/ Cooling Prohibit	**Open Circuit: R1 Closed on Heating or Cooling** Closed Circuit: R1 Closed on Heating 10kΩ : Cooling Mode Prohibit
S6	R2 Output Mode	**Open Circuit: R2 Closed on Fault Condition** Closed Circuit: R2 Closed on Pump Run

*If Heat and Cool request then Last Mode On is selected, inputs S1 and S2 should not be active simultaneously

Output	Name	Operation
R1	Heating/ Cooling	S5 Open Circuit : Closed on Space Heating/Cooling S5 Closed Circuit : Closed on Active Space Heating
R2	Fault/ Pump	S6 Open Circuit : Closed on Unit Fault S6 Closed Circuit : Pump Run

Space Heating ON (S1) Input S1 will switch the unit into Space Heating and switch the unit ON leaving LWT Heating Setpoint unchanged when the input becomes short-circuit. An input resistance of 1-10kΩ on input S1 will switch the unit into Space Heating, switch the unit ON and set LWT Heating Setpoint to appropriate value. If the input S1 becomes open-circuit then the Space Heating will switch OFF.

Space Cooling ON (S2) Input S2 will switch the unit into Space Cooling and switch the unit ON leaving LWT Cooling Setpoint unchanged when the input becomes short-circuit. An input resistance of 1-10kΩ on input S2 will switch the unit into Space Cooling, switch the unit ON and set LWT Cooling Setpoint to appropriate value. If the input S2 becomes open-circuit then the Space Cooling will switch OFF.

DHW Tank On(S3) Input S3 will switch Tank ON leaving Tank Reheat Setpoint unchanged when the input becomes short-circuit. An input resistance of 1-10kΩ on input S3 will switch Tank ON and set Tank Reheat Setpoint to appropriate value. If the input S3 becomes open-circuit then Tank will switch OFF.

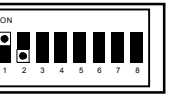
Enable Quiet Mode Operation (S4) When input S4 is closed-circuit the Quiet Mode function is activated and the unit will operate according to the Quiet Mode restrictions. When input S4 is open-circuit the unit will operate with no restriction.

Heating Interlock (S5) When input S5 is closed-circuit output R1 is closed only on Active Space Heating operation, where unit LWT mode is Heat, heat-pump compressor is running, and 3-port valve is switched to space heating . When input S5 is open-circuit output R1 is closed if Space Heating or Space Cooling is ON, even if compressor is off or DHW heating is occuring.

Cooling Prohibit (S5) A value of 10kΩ in input S5 will activate a Cooling Prohibit function. During Cooling Prohibit the Space Heating mode is set to HEAT. Selection of AUTO or COOL mode is prohibited using REMCON, Control Inputs or Modbus command. If Space Heating mode is changed from HEAT, the RTD will force the mode to revert to HEAT. When Cooling Prohibit is removed, the Space Heating mode will be restored to the mode in use before the Cooling Prohibit was activated. Heating Interlock function on R1 is not available if Cooling Prohibit is activated, in this case R1 is closed on Space Heating or Cooling.

Pump ON R2 Signal (S6) When input S6 is closed-circuit output R2 is closed when the pump is running and open when the pump is OFF. When input S6 is open-circuit output R2 signals Fault condition.

VOLTAGE CONTROL



For Voltage Control operation, SW1.1 should be ON and SW1.2 should be OFF.

Input	Name	Range (**default**)
S1	Space Heating On*	<0.5V: Heating OFF 0.6-0.9V: Heating ON 1-10V: Heating ON + LWT Heating Setpoint
S2	Space Cooling On*	<0.5V: Cooling OFF 0.5-0.9V: Cooling ON 1-10V: Cooling ON + LWT Cooling Setpoint
S3	DHW Tank On	<0.5V: DHW OFF 0.5-0.9V: DHW ON 1-10V: DHW ON and Set DHW Reheat Setpoint
S4	Enable Quiet Mode	**Open Circuit: Quiet Mode Disable** Closed Circuit: Quiet Mode Enable
S5	Heating Interlock / Cooling Prohibit	**Open Circuit: R1 Closed on Heating or Cooling** Closed Circuit: R1 Closed on Heating 10kΩ : Cooling Mode Prohibit
S6	R2 Output Mode	**Open Circuit: R2 Closed on Fault Condition** Closed Circuit: R2 Closed on Pump Run

*If Heat and Cool request then Last Mode On is selected, inputs S1 and S2 should not be active simultaneously

Output	Name	Operation
R1	Heating/ Cooling	S5 Open Circuit : Closed on Space Heating/Cooling S5 Closed Circuit : Closed on Active Space Heating
R2	Fault/ Pump	S6 Open Circuit : Closed on Unit Fault S6 Closed Circuit : Pump Run

Space Heating ON (S1) Input S1 will switch the unit into Space Heating and switch the unit ON leaving LWT Heating Setpoint unchanged when the input voltage is 0.6-0.9V. An input voltage of 1-10V on input S1 will switch the unit into Space Heating, switch the unit ON and set LWT Heating Setpoint to appropriate value. If the input voltage S1 is lower than 0.5V then the Space Heating will switch OFF.

Space Cooling ON (S2) Input S2 will switch the unit into Space Cooling and switch the unit ON leaving LWT Cooling Setpoint unchanged when the input voltage is 0.6-0.9V. An input voltage of 1-10V on input S2 will switch the unit into Space Cooling, switch the unit ON and set LWT Cooling Setpoint to appropriate value. If the input voltage S2 is lower than 0.5V then the Space Cooling will switch OFF.

DHW Tank On (S3) Input S3 will switch Tank ON leaving Tank Reheat Setpoint unchanged when the input voltage is 0.6-0.9V. An input voltage of 1-10V on input S3 will switch Tank ON and set Tank Reheat Setpoint

Enable Quiet Mode Operation (S4) When input S4 is closed-circuit the Quiet Mode function is activated and the unit will operate according to the Quiet Mode restrictions. When input S4 is open-circuit the unit will operate with no restriction.

Heating Interlock (S5) When input S5 is closed-circuit output R1 is closed only on Active Space Heating operation, where unit LWT mode is Heat, heat-pump compressor is running, and 3-port valve is switched to space heating . When input S5 is open-circuit output R1 is closed if Space Heating or Space Cooling is ON, even if compressor is off or DHW heating is occuring.

Cooling Prohibit (S5) A value of 10kΩ in input S5 will activate a Cooling Prohibit function. During Cooling Prohibit the Space Heating mode is set to HEAT. Selection of AUTO or COOL mode is prohibited using REMCON, Control Inputs or Modbus command. If Space Heating mode is changed from HEAT, the RTD will force the mode to revert to HEAT. When Cooling Prohibit is removed, the Space Heating mode will be restored to the mode in use before the Cooling Prohibit was activated. Heating Interlock function on R1 is not available if Cooling Prohibit is activated, in this case R1 is closed on Space Heating or Cooling.

Pump ON R2 Signal (S6) When input S6 is closed-circuit output R2 is closed when the pump is running and open when the pump is OFF. When input S6 is open-circuit output R2 signals Fault condition.

SEQUENCER MODE

For Sequencer Mode operation, SW1.1 should be OFF and SW1.2 should be ON. Note that Unit Control method must be set to Leaving

Water Temperature control for correct operation in Sequencer Mode.

Input	Name	Range (default)
S1	Space Heating On	On Open Circuit: Heating OFF On Closed Circuit: Unit ON and Heat Mode
S2	Space Cooling On	On Open Circuit: Cooling OFF On Closed Circuit: Unit ON and Cool Mode
S3	DHW Reheat Disable	**Open Circuit: DHW Reheat Enable and Restore DHW On/Off state after DHW Reheat Disable** Closed Circuit: DHW Reheat Disable
S4	Enable Quiet Mode	**Open Circuit: Quiet Mode Disable** Closed Circuit: Quiet Mode Enable
S5	SPARE	**Not In Use**
S6	Leaving Water Heating/ Cooling Setpoint	**Open Circuit: Not Active** 1~10VDC : On Voltage Change set Leaving Water Heating/Cooling Setpoint

Output	Name	Operation
R1	Heating/ Cooling	Closed on Space Heating/Cooling operation
R2	Fault	Unit Fault Condition

Space Heating ON (S1) Input S1 will switch the unit into Space Heating and switch the unit ON when the input becomes closed-circuit. If the input becomes open-circuit then the space heating will switch OFF. After an ON or OFF pulse has occurred the unit can be manually adjusted using the Remcon or Modbus command.

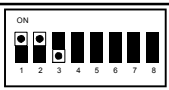
Space Cooling ON (S2) Input S2 will switch the unit into Space Cooling and switch the unit ON when the input becomes closed-circuit. If the input becomes open-circuit then the space cooling will switch OFF. After an ON or OFF pulse has occurred the unit can be manually adjusted using the Remcon or Modbus command.

DHW Reheat Disable (S3) When input S3 is closed-circuit the operation of DHW Reheat is disabled and cannot be activated from the Remcon or via Modbus command. When input S3 is open-circuit DHW can be operated normally. After Reheat Disabled operation, when input S3 becomes open-circuit the DHW on/off state is restored to the same condition as before DHW Reheat Disable occurred.

Enable Quiet Mode Operation (S4) Input S4 will activate Quiet Mode and the unit will operate according to the Quiet Mode restrictions when the input becomes closed circuit. If the input becomes open-circuit then Quiet mode is deactivated and the unit will operate with no restriction. After the closed-circuit or the open-circuit on input S4 has occured Quiet Mode can be manually adjusted using the Remcon or Modbus command.

Leaving Water Heating/Cooling Setpoint (S6) An input voltage of 1~10VDC applied to input S6 will set the current leaving water heating or cooling setpoint according to Table 3. when the voltage input changes by more than 0.1V, and the input voltage corresponds to a valid setpoint in the current mode of operation. Input S6 is active if the input is at least 1.0VDC. If the input has a value of <0.5VDC or is open-circuit then the input function is disabled. Leaving water heating or cooling setpoint can be also manually adjusted using the Remcon or Modbus command.

SMART GRID MODE



For Smart Grid Mode operation, SW1.1 and SW1.2 should be ON, SW1.3 should be OFF. In Smart Grid Mode the RTD Address Range is 0 to 15 set using the configuration switches SW1.5 to SW1.8.

In Smart Grid Mode inputs can be configured using SW1.4 to operate with either Permanent Enforcement, or with Time Limited Enforcement. In Time Limited Enforcement a closed circuit on the input will cause the input function to operate for a maximum of 3 hours after which the enforcement will clear. To extend the Time Limited Enforcement the input must pulse Open Circuit then return to Closed Circuit to reset the Timer. If the pulse is of a duration of less than 60 seconds the enforcement is not lifted during the pulse period.

Enforce Input Permanently

Time Limited Enforcement

Input	Name	Range (**default**)
S1	Prohibit Space Heating or Cooling	**Open Circuit: Not Active** Closed Circuit: Prohibit Space Heating or Cooling
S2	Prohibit DHW	**Open Circuit: Not Active** Closed Circuit: Prohibit DHW
S3	Prohibit Electric Heaters	**Open Circuit: Not Active** Closed Circuit: Prohibit DHW Booster Heater and Backup Heater
S4	Prohibit All Operation	**Open Circuit: Not Active** Closed Circuit: Prohibit all functions
S5	PV Available	**Open Circuit: Not Active** Closed Circuit: PV Energy Available for storage
S6	Powerful Boost	**Open Circuit: Not Active** Closed Circuit: Run Powerful Booster

Output	Name	Operation
R1	Heating/ Cooling	Closed on Space Heating/Cooling
R2	Fault	Closed on Unit Fault

Prohibit Space Heating or Cooling (S1) Prohibits Space Heating or Cooling operation in both MAIN and ADD zones (if ADD zone operation configured). When prohibition is removed the previous on or off state will be restored.

Prohibit DHW (S2) Prohibits DHW Reheat or Boost operation. When prohibition is removed the previous on or off state of Reheat and Boost will be restored.

Prohibit Electric Heaters (S3) Prohibits operation of DHW Booster Heater and Backup Heater. DHW Booster Heater operation is prohibited by the setting of field code 4-03-0, when prohibit is removed the field code 4-03-1 is written to enable Booster Heater operation. Backup Heater operation is prohibited by the setting of field code 4-00-0, when prohibit is removed the field code 4-00-1 is written to enable Backup Heater. At power-up or reset of P1P2 communications the setting of S3 is re-applied. In cases where DHW Booster Heater can still be manual operated, if DHW Booster Heater is switched ON during Prohibit Operation then the Booster Heater will be overidden OFF.

Prohibit All Operation (S4) Prohibits Space Heating and Cooling, DHW and Electric Heaters. When prohibition is removed Space Heating/Cooling On/Off state, DHW Reheat and Boost on/off states are restored.

PV Available (S5) Indicates electrical energy available from local Photovoltaic (PV) system or other local electrical energy source. When PV Available is indicated, RTD will run DHW Reheat with current DHW Reheat setpoint. When PV Available signal is removed DHW settings will be restored. PV Available has higher priority than all Prohibit functions so will operate even if prohibit functions are active.

Powerful Boost (S6) Powerful Boost will override current DHW operation and run DHW Boost. If DHW is currently Off, the Powerful Boost will set DHW on. When Powerful Boost is removed the previous DHW operation will be restored. Powerful Boost has higher priority than PV Available and all Prohibit functions so will operate even if other prohibit or override functions are active. During Powerful Boost the RTD will send a DHW Boost ON command every 5 minutes, it is possible to manually switch the DHW Boost OFF, this will be overriden on the next Boost ON Command sent from the RTD.

Note that any commands that prohibit or enable DHW Booster and Backup heater operation will write field codes to the indoor unit PCB. After a field code write the system will be restarted by the RTD and the Remote Controller will display BUSY and the RTD LEDs will show the P1P2 Search sequence. The RTD will take up to 6 minutes before the P1P2 Search sequence completes.

Modbus Protocol

MODBUS CONFIGURATION

Network	3 wire RS485
Mode	Modbus RTU Slave
Baud	9600*
Parity	None*
Stop bits	1
Register Base	0

**RTD interfaces can be configured with different baud rate and parity settings if required*

Modbus address range 0 to 63 set using SW1 (Figure 9) **except** for Smart Grid Mode where only Modbus Address 0 to Address 15 supported.

*Details of the Modbus Protocol can be found in the **Modicon Modbus Protocol Reference Guide** available on the internet.*

MODBUS REGISTERS

The RTD-LT/CA supports two types of register, analogue *Holding Registers* and analogue *Input Registers*. Register Addresses are '0' based in the range 0..65535.

Register Type	Access	Function
Holding Register	Read/Write	Control and Command Registers
Input Register	Read Only	Readback and Monitoring Registers

All analogue and digital values are accessed through these registers. All register values are 2 byte (16 bit) values except where otherwise indicated.

Different data types are returned using the following conventions

Data Type	Range	Convention
Digital	0..1	=0: FALSE, <>0 : TRUE
16 bit Integer (signed)	-32768.. 32767	Two's complement
16 bit Integer (unsigned)	0..65535	No scaling required
32 bit Integer (unsigned)	0.. 4294967295	Stored in two consecutive registers R,R+1 R contains the High 16 bit Word R+1 contains the Low 16 bit Word
x100 Temperature	-327.68.. 327.67	Temperatures values are generally returned *multiplied by 100* to allow greater precision. To allow for negative temperature the value is returned as a *signed integer,* this means that any value greater than 32767 must be converted into a negative value by subtracting 65536. Examples: A readback value of 2150 is a positive temperature so: 2150 / 100 = 21.50°C A readback value of 65036 is a negative temperature so: 65036 – 65536 = -500 -500 / 100 = -5.00°C

Registers are accessed using standard Modbus functions. The following four functions are supported by the RTD interface.

Function Code (hex code)	Function Name	Register Count
03 (03h)	Read Holding Registers	1..10
04 (04h)	Read Input Registers	1..10
06 (06h)	Preset Single Holding Register	1
16 (10h)	Preset Multiple Holding Register	1..10

In this document, Holding registers are written as **`H0010`** where '**`H`**' indicates *Holding* register and '**`0010`**' indicates the register address 0010. Similarly Input registers are referred to as **`I0010`** where '**`I`**' indicates an *Input* register

SPECIAL MODBUS REGISTER VALUES

The Modbus Input and Holding registers will return special values under certain conditions as shown in the following table.

Register Value (unsigned)	Signed Format	Hex Format	Indication
32767	32767	0x7FFF	Register not implemented
32768	-32768	0x8000	Function not available
32769	-32767	0x8001	Waiting for value

Depending on model, certain Holding Register and Input Register functionality may not be available. After a reset, or in cases where functionality is not available for the attached model the register value will report 32768 : 'Function not available'.

After connecting and identifying the system, the value 32769 : 'Waiting for value' will be reported by all registers that are waiting for live data from the connected LT Altherma system.

HOLDING REGISTER UPDATE MODE

Every Holding Register control field has a corresponding Update Register which determines how the control commands update the unit and if the corresponding Remcon functions can be updated by the from the Remcon. Four update modes are available:

Update Mode	Keypad Button(s)	Functionality
0:LastTouch	Unlocked	Unit setting is updated when a holding register WRITE occurs even if the value is unchanged.
1:Central	Locked	The corresponding REMCON function fixed to the Holding Register value. If Remcon value is adjusted value is overwritten by value in Holding Register.
2:Local	Unlocked	Updates to holding registers are not sent to the unit.
3:OnChange	Unlocked	Unit setting is updated when a holding register WRITE occurs only if the value CHANGES.

The *Last Touched* update mode allows updates from Remcon or Modbus registers. This requires that WRITES to the Modbus holding register only occur when a change is made. If the Modbus master repeatedly writes the value then this will overwrite the user setting. The *On Change* update mode can be used if repeated writes occur, in which case updates are only sent to the indoor unit if the written value changes. For each Holding register listed in the Unit Control table, the corresponding Update Register is the Control Register + 200. For example, the Update Register for LWT Heating Setpoint (`H0001`) would be `H0201`.

SEQUENCER MODE MODBUS SUPPORT

The following Modbus Tables are valid for all RTD-LT/CA modes **except** Sequencer Mode.

The Modbus Table and Modbus functionality in Sequencer Mode is modified to match the Modbus Table as documented in **RTD-W Installation Instructions** available from ***www.realtime-controls.co.uk/rtd***.

Control Functions

UNIT CONTROL

Unit Control functions are available in Modbus Holding Registers. All Unit Control Registers can be treated as *signed 16 bit integers*. High Resolution registers are shown in brackets where applicable.

Holding Register	Name	Range (Factory Settings)
`H0001`	Leaving water MAIN setpoint in heating mode*	25-55°C
`H0002`	Leaving water MAIN setpoint in cooling mode*	5-22°C
`H0003`	Operation Mode	0..2 (0=Auto, 1=Heating, 2=Cooling)
`H0004`	Space Heating/Cooling On/Off	0..1 (0:Off, 1:On)
`H0006`	Room Thermostat control Heating Setpoint	12-30°C
`H0007`	Room Thermostat control Coolin Setpoint	15-35°C
`H0009`	Quiet mode operation	0..2 (0:Disable, 1:Enable, 2:Auto)
`H0010`	DHW Reheat Setpoint*	30-60°C
`H0012`	DHW Reheat On/Off	0..1 (0:Off, 1:On)
`H0013`	DHW Booster Mode On/Off	0..1 (0:Off, 1:On)
`H0020`	Reset Pump Run Hour Counter	(55555 = Reset)
`H0021`	Reset Compressor Run Hour Counter	(55555 = Reset)
`H0050`	Simulated Room Temperature	0-50°C

H0053	MAIN Weather Dependent Mode	0: mode not active, 1: mode active for Heating only, (triggers P1P2 reset) 2: Not Supported, 3: mode active for Heating and Cooling (triggers P1P2 reset)
H0054	MAIN Weather Dependent leaving water temperature heating setpoint offset	-10..+10°C
H0055	MAIN Weather Dependent leaving water temperature cooling setpoint offset	-10..+10°C
H0061	Leaving water ADD setpoint in heating mode*†	25-55°C
H0062	Leaving water ADD setpoint in cooling mode*†	5-22°C
H0063	ADD Weather Dependent Mode†	0: mode not active, 1: mode active for Heating only, (triggers P1P2 reset) 2: Not Supported, 3: mode active for Heating and Cooling (triggers P1P2 reset)
H0064	ADD Weather Dependent leaving water temperature heating setpoint offset†	-10..+10°C
H0065	ADD Weather Dependent leaving water temperature cooling setpoint offset†	-10..+10°C
H0066	LWT On/Off in two-zone mode with Room Temperature Control‡	0..1 (0:Off, 1:On)

*Not available if weather dependent mode for selected mode is active

†Available if two-zone operation is active, otherwise returns 32768

‡Available if two-zone operation is active with Room Temperature Control, otherwise returns 32768

The available functions depend on the functions available on the attached equipment.

DHW Reheat and DHW Booster Mode If DHW Booster Mode is set to ON then if DHW Reheat is currently OFF, the DHW Reheat will be set to ON to allow Booster Operation.

Leaving Water Temperature (LWT) MAIN Setpoint (Heating and Cooling Modes) Value is NOT available if corresponding Weather Dependent Mode is active. Active in one zone operation or in two zone operation where ADD zone is not indicating demand. If LWT modulation is active then changing of Room Thermostat setpoint will update current LWT setpoint to calculated value. A write to the LWT Holding register will overwrite the calculated modulation value. Actual Leaving Water Temperature Setpoint in current mode is returned in I0046.

Room Thermostat Setpoint (Heating and Cooling Modes) is available only if Room Thermostat or External Room Thermostat control is active.

Simulated Room Temperature allows RTD to simulate as **In Room** REMCON. Writing a value greater than 0°C causes the RTD to operate as **In Room** and the REMCON to be configured as **At Unit**. The simulated temperature can be used for Room Thermostat control, LWT Modulation and Room frost protection. If the Simulated Room Temperature is set to 0, or the RTD is removed from the P1P2 network or powered down then the REMCON will remain in current configuration.

Weather Dependent (WD) MAIN Mode can be activated either by field setting or by writing to Weather Dependent MAIN Mode Holding Register (H0053). Active in one zone operation or in two zone operation where ADD zone is not indicating demand. WD Mode can be selected to be either Heating Only (value = 1) or Heating and Cooling (value = 3). Setting a WD mode will cause a P1P2 reset to occur and the REMCON

and RTD will go the busy state until the reset is complete. When WD is selected, the corresponding LWT Setpoint Holding register is not available. The Weather Dependent LWT Setpoint Heating and Cooling Offsets (H0054 and H0055) can be used to alter the setpoint shift, and readback the current setpoint shift for the support modes. The actual Leaving Water Temperature Setpoint is available in I0046.

Leaving Water Temperature (LWT) ADD Setpoint (Heating and Cooling Modes) Value is NOT available if corresponding Weather Dependent Mode is active. Active in two zone operation where ADD zone is indicating demand. If LWT modulation is active then changing of Room Thermostat setpoint will update current LWT setpoint to calculated value. A write to the LWT Holding register will overwrite the calculated modulation value. Actual Leaving Water Temperature Setpoint in current mode is returned in I0047.

Weather Dependent (WD) ADD Mode can be activated either by field setting or by writing to Weather Dependent ADD Mode Holding Register (H0063). Active in two zone operation where ADD zone is indicating demand. WD Mode can be selected to be either Heating Only (value = 1) or Heating and Cooling (value = 3). Setting a WD mode will cause a P1P2 reset to occur and the REMCON and RTD will go the busy state until the reset is complete. When WD is selected, the corresponding LWT Setpoint Holding register is not available. The Weather Dependent LWT Setpoint Heating and Cooling Offsets (H0064 and H0065) can be used to alter the setpoint shift, and readback the current setpoint shift for the support modes. The actual Leaving Water Temperature Setpoint is available in I0047.

GROUP READBACK

The following input registers give common readback values for unit operation.

Input Register	Name	Range
I0021	Unit ERROR	0..1 (0:No Error, 1:Error)
I0022	Unit ERROR Code	RTD ASCII Format*
I0023	Unit ERROR Sub Code	0-99
I0028	Emergency Operation	0..1 (0:Off, 1:On)
I0029	ADD Zone Running	0..1 (0:Off, 1:On)
I0030	Circulation pump operation	0..1 (0:Off, 1:On)
I0031	Compressor Run	0..1 (0:Off, 1:On)
I0032	Booster Heater Run†	0..1 (0:Off, 1:On)
I0033	Disinfection operation	0..1 (0:Off, 1:Busy)
I0034	Backup Heater Level 1,2†	0..2 (0:Off, 1,2: Level)
I0035	Defrost/start up mode	0..1 (0:Off, 1:Busy)
I0036	Hot Start	0..1 (0:Off, 1:Busy)
I0037	3-Way Valve	0..1 (0:Space Heat/Cool, 1: DHW)
I0038	Solar Pump	0..1 (0:Off, 1:On)
I0040	Leaving Water Temperature	°C x100 Temperature
I0041	Leaving Water Temperature PHE	°C x100 Temperature
I0042	Inlet Water Temperature	°C x100 Temperature
I0043	Domestic Hot Water Temperature†	°C x100 Temperature
I0044	Outside Air Temperature	°C x100 Temperature
I0045	Liquid Refrigerant Temperature	°C x100 Temperature
I0046	Current Leaving Water Temperature MAIN Setpoint	°C x100 Temperature
I0047	Current Leaving Water Temperature ADD Setpoint†	°C x100 Temperature
I0048	External Sensor	°C x100 Temperature

I0049	Flow Rate	litre/s x100
I0050	Measured Room Temperature	°C x100 Temperature
I0051	Current DHW Setpoint	°C x100 Temperature

†Available functions may vary by model and option settings

*RTD ASCII Fault Code generation functions are documented in the 'RTD-NET Installation Instructions' available at **www.realtime-controls.co.uk/rtd**

For Error code information refer to Daikin Service manual

Input Register	Name	Range
I0080	Pump Running Hours Accumulated	High 16 bit Word
I0081	Pump Running Hours Accumulated	Low 16 bit Word
I0082	Compressor Running Hours Accumulated	High 16 bit Word
I0083	Compressor Running Hours Accumulated	Low 16 bit Word
I0201	Heatpump Supports Heating	0..1 (0:No, 1:Supported)
I0202	Heatpump Supports Cooling	0..1 (0:No, 1:Supported)
I0203	DHW Installed	0..1 (0:No, 1:Installed)
I0204	Backup Heater Installed	0..1 (0:No, 1:Installed)
I0205	Room Temperature Control Active	0..1 (0:No, 1:Active)
I0206	Leaving Water Temperature Control Active	0..1 (0:No, 1:Active)
I0307	Capacity Code	kW x 10

Pump Running Hours and **Compressor Running Hours** are Non-Volatile values stored in the RTD and retained if the RTD is powered down. The value can be reset to zero by writing a value of 55555 to **H0020** for Pump Running Hours and **H0021** for Compressor Running Hours

SETPOINT RANGES

The Setpoint Ranges for Leaving Water Temperature Heating and Cooling Setpoints and DHW Reheat Maximum setpoint are set in field settings. The minimum and maximum values are reported in the following Input Registers.

Setpoint Field (°C x 1)	**Minimum Register**	**Maximum Register**
Leaving Water Heating Setpoint (MAIN ZONE)	I0301	I0401
Leaving Water Cooling Setpoint (MAIN ZONE)	I0302	I0402
Leaving Water Heating Setpoint (ADD ZONE)	I0303	I0403
Leaving Water Cooling Setpoint (ADD ZONE)	I0304	I0404
DHW Reheat Setpoint	I0305†	I0405
DHW Boost Setpoint	I0306†	I0406†

†cannot be changed by field setting.

ENERGY METERING

The values for Accumulated Total Consumed and Produced kWh energy are available in the following Input Registers. Values are 32 bit so two Input Registers are used for each field. Values are reported in kWh x 100 so a value of 100 is equal to 1.00 kWh. The TOTAL field is calculated by the RTD from the sum of Space Heating, Space Cooling and Tank Accumulated Power.

Field	32 bit Field	Consumed Power (kWh x 100)	Produced Power (kWh x 100)
Space Heating	16 bit High Word	I0162	I0172
	16 bit Low Word	I0163	I0173
Space Cooling	16 bit High Word	I0262	I0272
	16 bit Low Word	I0263	I0273
Tank	16 bit High Word	I0362	I0372
	16 bit Low Word	I0363	I0373
TOTAL	16 bit High Word	I0062	I0072
	16 bit Low Word	I0063	I0073