Installation and Operating Instructions

RBC-TSI1 Interface

■ Important

This manual is intended for those who have the required knowledge/Qualifications for electric or control and are in charge of any of the following:

- Installation of the product
- Design of the control system
- Management of the site

■ Agreements for use of this product

(1) Scope of warranty

If a failure occurs in this product as a result of our fault or negligence we will provide replacement or repair of the product.
We will not be responsible if the fault occurs as a result of any of the following.

- The product was handled or used under conditions/environment that are not specified in this manual.
- The failure was caused by aspects outside of this product.
- The product was altered or repaired by persons other than Toshiba Carrier.
- The product was not used in accordance with its original purpose.
- The cause of the failure was not foreseeable with our scientific and technical levels at the time of shipping.
- The failure is due to a natural calamity, disaster, or the like.

The warranty mentioned here shall cover only this product, and any damage and losses resulting from the failure of this product shall be excluded from the scope of warranty.

(2) Restrictions of liability

In no event shall we be liable for any special, indirect, or consequential damage arising out of or in connection with the use of this product.

(3) Conditions for use of this product

- When this product is to be used in combination with other products, the dealer or qualified professional shall check the applicable standards, specifications, laws, and regulations beforehand. The dealer or qualified professional shall also verify that this product conforms to the customer's system, machines, and/or equipment in which this product is to be used. If the dealer or qualified professional fails to do so, we shall not be responsible for the conformity of this product.
- When you wish to use this product for any of the following purposes, be sure to consult our sales staff and use this product with a margin of rating and performance, as well as take appropriate safety measures for safety circuit, mechanism, etc. that will minimize danger in case of a failure.
  - Use this product outdoors or for purposes that may cause latent chemical contamination or electrical interference or use under conditions/environment that are not specified in this manual.
  - Use this product in nuclear power control facilities, incineration facilities, railway/airline/vehicle facilities, medical equipment, amusement machines, safety devices, and equipment/facilities that are restricted by administrative organizations and/or respective industries.
  - Use this product in systems, machines, or equipment that may pose a danger to human life or properties.
  - Use this product in systems or facilities that require high reliability, such as gas/water/electricity supply systems and non-stop operation systems.
  - Use this product for other purposes that require a high level of safety.
- Thoroughly understand and strictly observe all prohibitions and precautions for use stated in this manual to prevent contingent damage or losses to you or other persons due to improper use of this product.

(4) Changes to specifications
The specifications described in this manual is subject to change for improvement or other reasons without notice.
Contact our sales staff to confirm the latest specifications of this product.

■ Warning Indications on the Air Conditioner Unit

Warning indication	Description
WARNING **ELECTRICAL SHOCK HAZARD** Disconnect all remote electric power supplies before servicing.	**WARNING** **ELECTRICAL SHOCK HAZARD** Disconnect all remote electric power supplies before servicing.
WARNING Moving parts. Do not operate unit with grille removed. Stop the unit before the servicing.	**WARNING** **Moving parts.** Do not operate unit with grille removed. Stop the unit before the servicing.
CAUTION High temperature parts. You might get burned when removing this panel.	**CAUTION** High temperature parts. You might get burned when removing this panel.
CAUTION Do not touch the aluminum fins of the unit. Doing so may result in injury.	**CAUTION** Do not touch the aluminium fins of the unit. Doing so may result in injury.
CAUTION **BURST HAZARD** Open the service valves before the operation, otherwise there might be the burst.	**CAUTION** **BURST HAZARD** Open the service valves before the operation, otherwise there might be the burst.

IMPORTANT INFORMATION

➢ **All electrical work should be carried out by a competent person and wiring must be in accordance with the national electrical installation regulations.**
➢ **Ensure that installation work is done correctly using the information contained in this manual.**
➢ **Make all connections securely so that any outside forces acting on the cables are not applied to the terminals.**
➢ **Never modify or repair by yourself.**
   Any attempt to do so will void the warranty.
➢ **To dispose of this product, consult your dealer.**

⚠ WARNING

1. **Using the specified wires, ensure to connect the wires, and fix wires securely so that the external tension to the wires do not affect the connecting part of the terminals.**
   Incomplete connection or fixation may cause a fire, etc.
2. **Be sure to connect earth wire. (grounding work) Incomplete grounding** cause an electric shock. Do not connect ground wires to gas pipes, water pipes, lightning rods or ground wires for telephone wires.
3. **Appliance shall be installed in accordance with national wiring regulations.**
   Capacity shortage of power circuit or incomplete installation may cause an electric shock or a fire.

⚠ CAUTION

• If incorrect/incomplete wiring is carried out, it will cause an electrical fire or smoke.
• Be sure to install an earth leakage breaker that is not tripped by shock waves.
  If an earth leakage breaker is not installed, an electric shock may be caused.
• Be sure to use the cord clamps attached to the product.
• Do not damage or scratch the conductive core and inner insulator of power and inter-connecting wires when peeling them.
• Use the power cord and Inter-connecting wire of specified thickness, type, and protective devices required.
• Never connect 220-240V power to the terminal blocks (A , B , U1/U2, U3/U4 etc.) for control wiring (Otherwise, the system will fail).

REQUIREMENT

• For power supply wiring, strictly conform to the Local Regulation in each country.
• For wiring of power supply of the outdoor units, follow the Installation Manual of each outdoor unit.
• Perform the electric wiring so that it does not come to contact with the high-temperature part of the pipe. The coating may melt resulting in an accident.
• After connecting wires to the terminal blocks, provide a trap and fix wires with the cord clamp.
• Run the refrigerant piping line and control wiring line in the same line.
• Do not turn on the power of the indoor unit until vacuuming of the refrigerant pipes completes.

■ Power supply wire and communication wires specifications

Power supply wire and communication wires are procured locally.
For the power supply specifications, follow to the table below. If capacity is little, it is dangerous because overheat or seizure may be caused. For specifications of the power capacity of the outdoor unit and the power supply wires, refer to the Installation Manual attached to the outdoor unit.

Indoor unit power supply

• For the power supply of the indoor unit, prepare the exclusive power supply separated from that of the outdoor unit.
• Arrange the power supply, earth leakage breaker, and main switch of the indoor unit connected to the same outdoor unit so that they are commonly used.
• Power supply wire specification : Cable 3-core 2.5mm^2, **in conformity with Design 60245 IEC 57.**

▼ Power supply

Power supply	220-240V —, 50Hz	
Power supply switch/Earth leakage breaker or power supply wiring/fuse rating for indoor units should be selected by the accumulated total current values of the indoor units.		
Power supply wiring	Below 50m	2.5 mm^2

Control wiring, Central controller wiring

• 2-core with polarity wires are used for the Control wiring between indoor unit and outdoor unit and Central controller wiring.
• To prevent noise trouble, use 2-core shield wire,
• The length of the communication line means the total length of the inter-unit wire length between indoor and outdoor units added with the central control system wire length

Product Description

The RBC-TSI1 is a versatile interface for Toshiba air conditioning units, offering a wide range of external control facilities. The unit attaches to the TCC-NET A+B network. The interface is network powered and may be used with or without a remote controller being present. Up to eight indoor units may be monitored and controlled as a group by a single RBC-TSI1.

Hardware Interface:

Six analogue control inputs selectable as resistance or 0-10v D.C. Two relay outputs for 'Run' and 'Error' rated 24v 0.1A

Serial Interface:

RS-485 serial Modbus connection with slave addresses from 1 to 254 and configurable baud rates and parity. Modbus may be used for monitoring and control or to allow the operation of up to sixteen units in a 'Master/Slave' configuration.

Operating Modes:

Several modes of operation are available including special modes for energy saving and hotel applications. Modes are selected by a link and bit switches.

AVAILABLE MODES:		
1.	Standard operation with the facility to interconnect up to 16 interfaces as a 'Master/Slave' group.	(See Appendix B1)
2.	As (1) for VN units	(See Appendix B8)
3.	Preset mode operation.	(See Appendix B2)
4.	Local/Restore mode.	(See Appendix B3)
5.	Duty/Standby operation.	(See Appendix B4)
6.	Eco-1 (Timed Fan).	(See Appendix B5)
7.	Eco-2 (Fan Band).	(See Appendix B6)
8.	Hotel mode.	(See Appendix B7)
9.	AHU Mode	(See Appendix B9)

SPECIFICATION INDOOR INTERFACE

ELECTRICAL		ENVIRONMENTAL	
Model		RBC-TSI1	
Supply	15V-24V DC, 50mA	Storage Temperature Range	-10°C to 50°C
Power	<1.2VA	Operating Temperature range	0°C to 50°C
Relay	1A, 24VAC max	Humidity Range	0-90% RH non-condensing
	1A, 30VDC max	Mechanical	
Inputs Voltage Mode	S1..S6 0..10VDC <1mA	Casing	ABS Plastic
Inputs Resistance Mode	S1..S6 5V, 1mA	Dimensions	H90 x W107 x D32 mm
EMC Emissions	EN61000-6-1	Weight	120g
EMC Immunity	EN61000-6-3	Mounting	2 Key Slot or DIN Rail
Connectors	Rising clamp to 0.75^{2}mm	Protection	IP30

SPECIFICATION FOR CONNECTION CABLES

INPUT	DESCRIPTION		
S1 to S6	Cable Type	2-core shield wires	Screen must be earthed at one end only
	Wire size and max. length	1.0 mm^2 200m max. (min. 0.5 mm^2)	It is recommended that volt-free contacts or switch mechanisms connected to S4, S5 and S6 have gold plated contacts to ensure low resistance circuit

Resistances should be within +/-250 ohms of the quoted value. Open circuit is R>200kΩ. Voltages should be within +/- 0.25V of the quoted value. Open circuit for V<1V. Under open circuit conditions the input will revert to its default value. S1 in resistance mode is designed to be operated using a linear 10kΩ variable resistance.

Mechanical Data

⚠ **CAUTION**

- ◆ **Do not exceed the specified fault relay ratings**
- ◆ **Observe precautions for handling**
  electrostatic sensitive devices
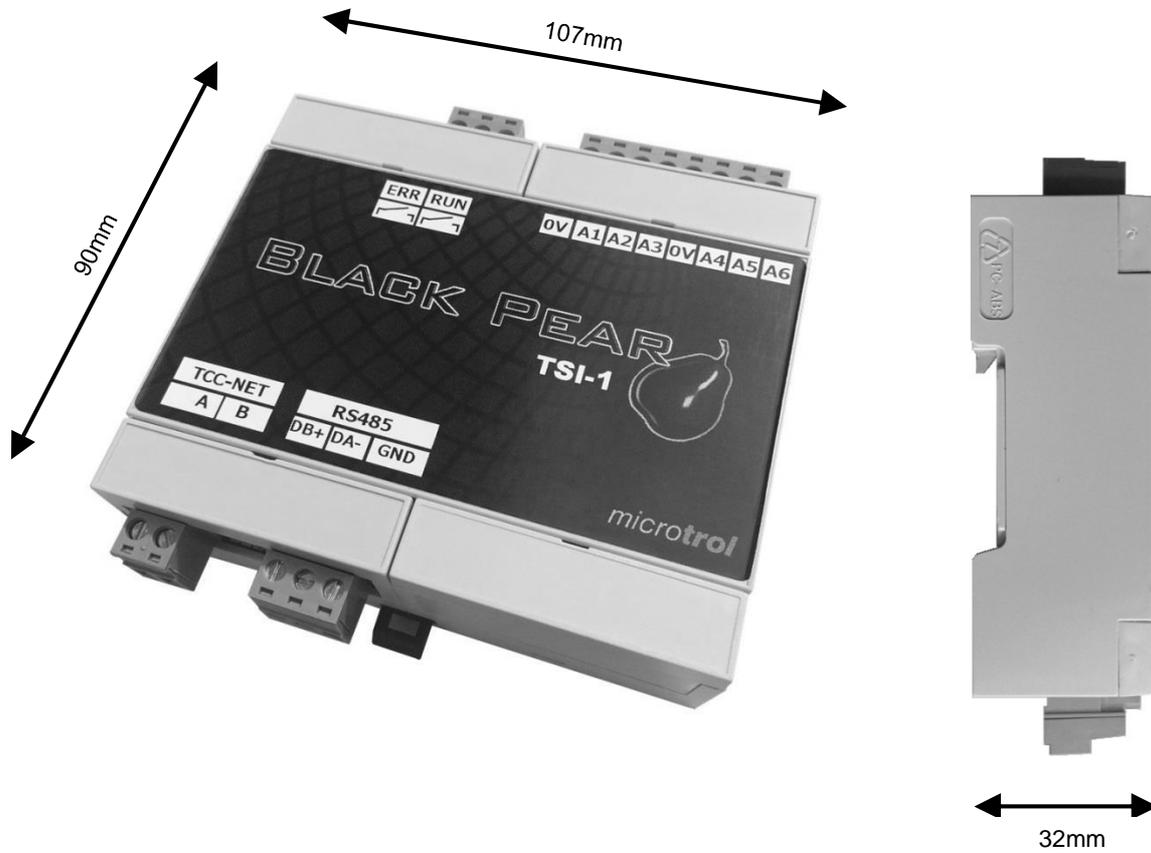
Wiring Information

⚠ CAUTION

- ◆ All electrical work should be carried out by a competent person and wiring must be in accordance with the national electrical installation regulations.

Run Relay
24v 0.1A

Error Relay
24v 0.1A

Analogue
Inputs

ERR RUN

0V A1 A2 A3 0V A4 A5 A6

BLACK PEAR
TSI-1

TCC-NET   RS485
A   B   DB+ DA⁻ COM

microtrol

Configuration
Switches

Connect to Toshiba
A/B Network

Common

RS485
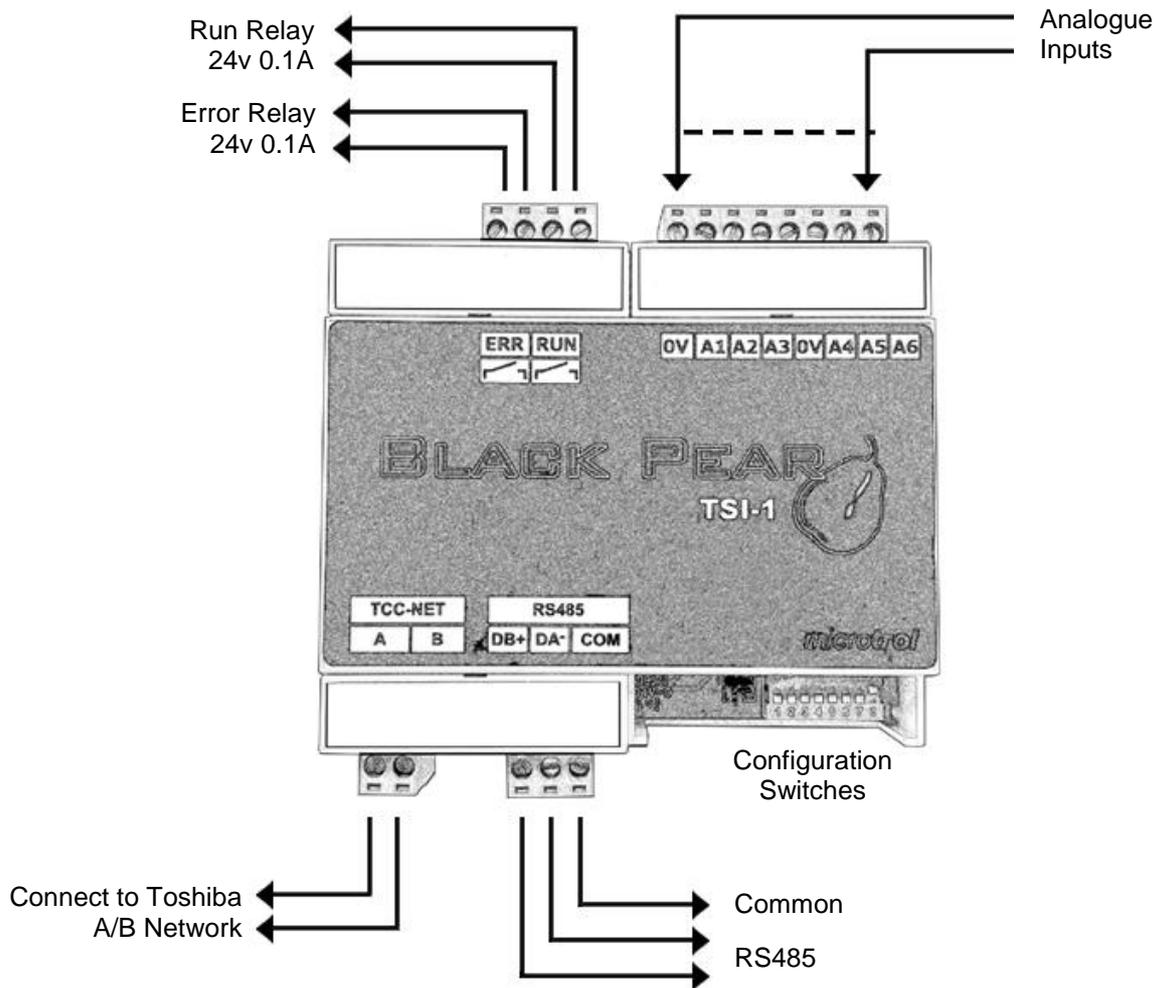
Appendix A: - Definitions

The following nomenclature is used throughout this document.

Modbus Holding Registers H-nn:
> These are the function 3/6/16 registers with offset nn.
> They are the same as registers 40000 + nn + 1
> Function 3 is used to read the registers
> Functions 6 and 16 may be used to send values to them.

Modbus Input Registers I-nn:
> These are the function 4 registers with offset nn.
> They are the same as registers 30000 + nn + 1
> Function 4 is used to read the registers
> These registers may not be written to.

e.g.   H-15 is equivalent to 400016 and is accessed for read/write
by Function 3/6/ 16 using offset 15.
I-24 is equivalent to 300025 and is accessed for read by Function 4 using offset 24.

Hardware Inputs:-

This means either the analogue inputs A1 to A6 or the internal registers H-51 to H-59, depending which set is selected by switch S1-6.

The analogue inputs A1 to A6 may be configured as Voltage (0-10v) or Resistance inputs.

Switch Settings Diagrams:-

The switch setting diagrams in this document use the following convention:

In the diagram opposite:
S1-1 to S1-4 are shown in the OFF position
S1-5 & S1-6 are shown in the ON position
S1-7 & S1-8 are shown as selectable

S2 is shown Unlinked
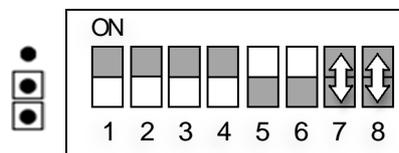
Selectable switches will have their functions described.

Appendix B: - Operating Modes

B1: Standard Mode

Master Unit
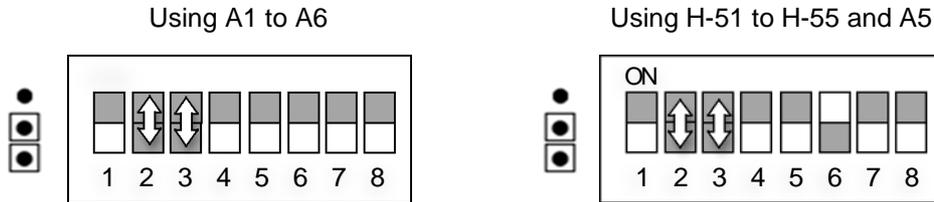
Using A1 to A6   Using H-51 to H-55 and A5

Switch Settings:

S1-2: Voltage or resistance inputs for A1 to A6

| OFF | = | Resistance | (for A5 active means linked to 0v) |
| ON | = | Voltage | (for A5 active means supplied with > 6.5v) |

S1-3: Enable sending of parameters to slave units 1 to 15

| OFF | = | Do not send |
| ON | = | Send |

A standard Master unit will accept hardware inputs from either A1-A6 or **H-51 to H-55**.

If S1-3 is set On then the unit will periodically send its parameters to standard Slave units with addresses 1 to 15

Input	A1/H-51	A2/H-52	A3/H-53	A4/H-54	A5	A6/H-55
Parameter	Set point (SP)	Fan Speed (FS)	Mode (MD)	Louvre (AD)	On/Off (I/O)	Lock

Slave Unit

Switch Settings:

Using A1 to A6   Using H-51 to H-55 and A5

S1-2: Voltage or resistance inputs for A1 to A6

    OFF   =   Resistance   (for A5 active means linked to 0v)
    ON   =   Voltage   (for A5 active means supplied with > 6.5v)

S1-3: Locked Slave/Locked Master

    OFF   =   Locked to Slave Defaults
    ON   =   Locked to Master Defaults

S1- 7 & S1-8: Modbus Address

    S1-7 Off   S1-8 Off   =   Invalid for slave unit.
    S1-7 Off   S1-8 On   =   1
    S1-7 On   S1-8 Don't Care   =   Address as set by C5 & C6

A standard Slave unit will accept **Hardware Inputs**

It will also accept values sent by a Standard Master unit if its address is in the range 1 to 15.

Lock function:

If any parameters are locked using the A6 /H-55 input then these parameters Will be locked to:-

    The **Hardware Inputs** settings on the Slave if S1-3 is Off
    The values from the Master if S1-3 is On

Input	A1/H-51	A2/H-52	A3/H-53	A4/H-54	A5	A6/H-55
Parameter	Set point	Fan Speed	Mode	Louvre	On/Off	Lock

B2: Pre-Set Slave Unit
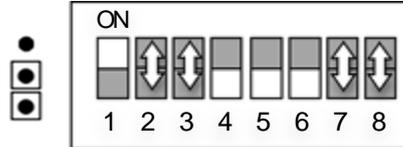
Switch Settings:

S1-2 &S1-3: Pre Set Mode

S1-2 Off	S1-3 Off	=	Unlocked
S1-2 Off	S1-3 On	=	Heat
S1-2 On	S1-3 Off	=	Cool
S1-2 On	S1-3 On	=	Auto

S1-7 & S1-8: Modbus Address

S1-7 Off	S1-8 Off	=	Invalid for slave unit.
S1-7 Off	S1-8 On	=	1
S1-7 On	S1-8 Don't Care	=	Address as set by C5 & C6

The Pre-Set Slave mode provides four simple modes without any **Hardware Inputs**.
The mode settings are as listed below:

Heat	Mode	=	Heat, SP	=	23, FS	=	Auto, Air Direction = Swing
Cool	Mode	=	Cool, SP	=	18, FS	=	Auto, Air Direction = Swing
Auto	Mode	=	Auto, SP	=	21, FS	=	Auto, Air Direction = Swing
Unlocked	All parameters set on RC.						

B3: Standard Slave with Local/Restore:
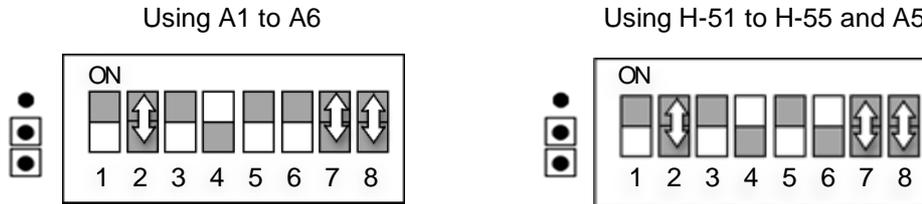
Using A1 to A6   Using H-51 to H-55 and A5

Switch Settings:

S1-2: Voltage or resistance inputs for A1 to A6

     OFF   =   Resistance   (for A5 active means linked to 0v)
     ON   =   Voltage   (for A5 active means supplied with > 6.5v)

S1-7 & S1-8: Modbus Address

     S1-7 Off   S1-8 Off   =   Invalid for slave unit.
     S1-7 Off   S1-8 On   =   1
     S1-7 On   S1-8 Don't Care   =   Address as set by C5 & C6

Input	A1/H-51	A2/H-52	A3/H-53	A4/H-54	A5	A6/H-55
Parameter	Set point	Fan Speed	Mode	Louvre	On/Off	Lock

Operation:-

When A6 is linked (or H55 = 0) the unit will use the Hardware inputs.

When A6 is 6.8k (or 7.75v) or H55 = 4 the unit will revert to the last values Used in this mode.

B4: Duty/Standby

Pre-Set Master Unit

Switch Settings

S1-2 & S1-3: Pre Set Mode

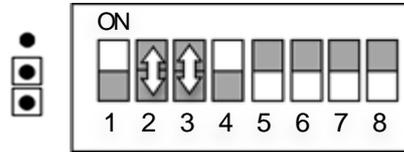|			
S1-2 Off	S1-3 Off	=	Local
S1-2 Off	S1-3 On	=	Heat
S1-2 On	S1-3 Off	=	Cool
S1-2 On	S1-3 On	=	Auto

In Duty/Standby two units operate alternately on a timed basis. The Master unit determines the control parameters and cycle time.
The cycle time is set by linking out one of the A1 to A6 inputs to provide the times listed below. The available modes are the same as the Pre-Set modes viz:-

Heat	Mode	=	Heat, SP	=	23, FS	=	Auto, Air Direction = Swing
Cool	Mode	=	Cool, SP	=	18, FS	=	Auto, Air Direction = Swing
Auto	Mode	=	Auto, SP	=	21, FS	=	Auto, Air Direction = Swing
Unlocked	All parameters set on RC of the Master.						

Time settings:

Link	Duty Time
A1	1 Min
A2	1 Hr
A3	6 Hrs
A4	2 Days
A5	1 Week
A6	2 Weeks

Errors:

Should the slave unit become unavailable or go into error then the Master will continue to run full time and an error condition will be generated.

Duty/Standby Slave
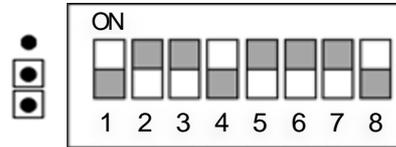
The Duty/Standby Slave unit operate with the same parameter values as it associated Master unit.

Should the Master unit stop sending values or go into error then the Slave unit will operate full time and an error condition will be generated

B5: Eco Timed Fan Mode

<div style="text-align:center">

Using A1 to A6   Using H-51 to H-54, A5 & A6

</div>

Switch Settings:

S1-2: Voltage or resistance inputs for A1 to A6

OFF	=	Resistance	(for A5 & A6 active means linked to 0v)
ON	=	Voltage	(for A5 & A6 active means supplied with > 6.5v)

S1-3, S1-4 & S1-5: Time before Fan mode used and Fan mode State.

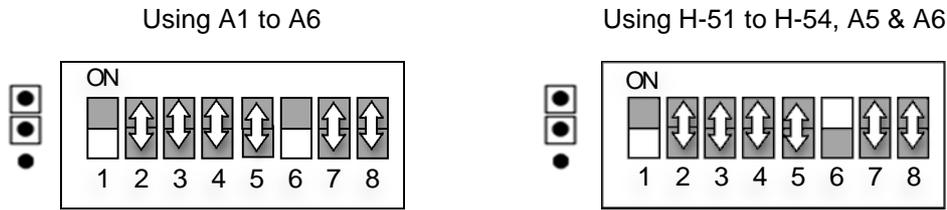|				Time	Fan State
				Time	Fan State
S1-3 On	S1-4 On	S1-5 Off	=	2 hrs	Normal
S1-3 On	S1-4 Off	S1-5 Off	=	60 mins	Normal
S1-3 Off	S1-4 On	S1-5 Off	=	30 mins	Normal
S1-3 Off	S1-4 Off	S1-5 Off	=	2 mins (Test)	Normal
S1-3 On	S1-4 On	S1-5 On	=	2 hrs	Waft
S1-3 On	S1-4 Off	S1-5 On	=	60 mins	Waft
S1-3 Off	S1-4 On	S1-5 On	=	30 mins	Waft
S1-3 Off	S1-4 Off	S1-5 On		INVALID (=ECO Fan Band Mode)	

(Normal mode = Fan & Louvre as set on A2 / A4 or H-52 / H-54)
(Waft mode = Fan forced to Low Speed and Louvre = 22deg)
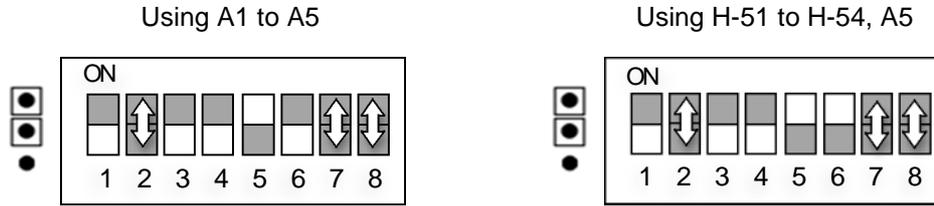
Switches 7 & 8: Modbus Address

S1-7 Off	S1-8 Off	=	Invalid for slave unit.
S1-7 Off	S1-8 On	=	1
S1-7 On	S1-8 Don't Care	=	Address as set by C5 & C6

In Eco Timed Fan mode the unit will, following switch on, operate with the parameters set on **Hardware Inputs** A1-A4 / H-51 to H-54 with A5 controlling On/Off. After 5 seconds the setpoint may be changed if required from the RC. Once the time has elapsed the unit will change its mode to Fan mode.

The sequence may be re-started by cycling the unit Off / On with A5, Modbus or using the RC. The sequence may also be re-started by linking the A6 input for 1 second. On restart the setpoint will revert to the A1/H51 value and may again be changed from the RC after 5 seconds.

Input	A1/H-51	A2/H-52	A3/H-53	A4/H-54	A5	A6
Parameter	Set point	Fan Speed	Mode	Louvre	On/Off	Restart

B6: Eco Fan Band Mode:

Using A1 to A5   Using H-51 to H-54, A5

Switch Settings:

S1-2: Voltage or resistance inputs for A1 to A5

OFF	=	Resistance	(for A5 active means linked to 0v)
ON	=	Voltage	(for A5 active means supplied with > 6.5v)

S1-7 & S1-8: Modbus Address

S1-7 Off	S1-8 Off	=	Invalid for slave unit.
S1-7 Off	S1-8 On	=	1
S1-7 On	S1-8 Don't Care	=	Address as set by C5 & C6

The Eco Fan Band mode allows the setting of two set points using the **Hardware Inputs**. When the RA is below the low set point the unit will operate in Heat mode with a set point of 30 degrees. When the return air temperature rises 1 degree above the low set point the unit will change to Fan mode. If the RA rises to the upper set point then the unit will operate in Cool mode with a set point of 18 degrees, reverting to Fan mode when the RA falls to 1 degree below the high set point.

Input	A1/H-51	A2/H-52	A3/H-53	A4/H-54	A5	A6
Parameter	Hi Set point	Fan Speed	Lo Set point	Louvre	On/Off	N/U

B7: Hotel Controller Mode:
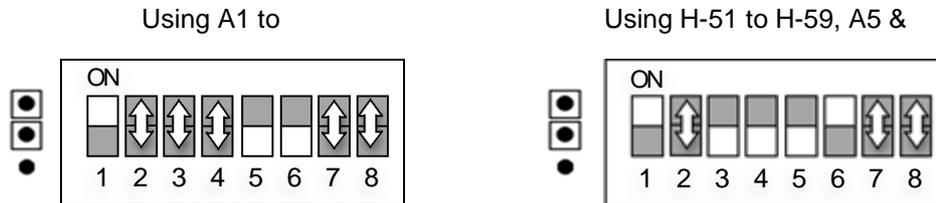
Using A1 to   Using H-51 to H-59, A5 &

Switch Settings:

S1-2: Voltage or resistance inputs for A1 to A6

OFF	=	Resistance	(for A5 & A6 active means linked to 0v)
ON	=	Voltage	(for A5 & A6 active means supplied with > 6.5v)

S1-3 & S1-4: Occupied Fan Speed (if using A1 to A6 mode [S1-6 = Off])

S1-3 Off	S1-4 Off	=	Auto
S1-3 Off	S1-4 On	=	Low
S1-3 On	S1-4 Off	=	Med
S1-3 On	S1-4 On	=	High

S1-7 & S1-8: Modbus Address

S1-7 Off	S1-8 Off	=	Invalid for slave unit.
S1-7 Off	S1-8 On	=	1
S1-7 On	S1-8 Don't Care	=	Address as set by C5 & C6

The Hotel mode provides for 'Occupied 'and 'Unoccupied' settings. The settings used may be selected with the A6 input. When the A6 input is active (linked) the 'Occupied' settings are used initially with the user then being able to change the settings using the RC. If A6 is open then the unit uses the 'Unoccupied' settings which are periodically refreshed to force the settings. In either mode the A5 input operates as an On/Off input and may be connected to a master switch, a window switch or both. Following an Off – On sequence on A5 the settings will be returned to the previous values unless the occupation state is also changed during this period. Changing of the occupation state always results in the basic 'Occupied' or 'Unoccupied' values being re-instated.

Input	A1/H-51	A2/H-52	A3/H-53	A4/H-54	A5	A6
Parameter	**Occ SP**	**Unocc SP**	**Occ MD**	**Unocc MD**	**On/Off**	**Occ/Unocc**

Input	H-56	H-57	H-58
Parameter	**Occ Fan Speed**	**Occ SP Min**	**Occ SP Max**

If S1-6 is OFF (Usng A1 to A6) then Occ Fan Speed is set by S1-3 & S1-4 and there are no Occ. SP Min /Max limits.

B8: VN Unit

Note: VN units and standard fan coils cannot be mixed on the same RBC-TSI1 or on Master/Slave groups of RBC-TSI1 units.

Master Unit

Using A1 to A6   Using H-51 to H-55 and A5

Switch Settings:

S1-2: Voltage or resistance inputs for A1 to A6

OFF	=	Resistance	(for A5 active means linked to 0v)
ON	=	Voltage	(for A5 active means supplied with > 6.5v)

S1-3: Enable sending of parameters to slave units 1 to 15
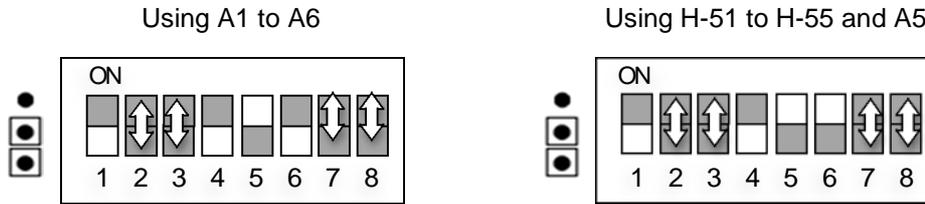
OFF	=	Do not send
ON	=	Send

A standard Master unit will accept analogue parameter inputs from either A1-A6 or **H-51 to H-55**.
If S1-3 is set On then the unit will periodically send its parameters to standard Slave units with addresses 1 to 15

Input	A1/H-51	A2/H-52	A3/H-53	A4/H-54	A5	A6/H-55
Parameter	Not Used	Fan Speed	Mode	Not Used	On/Off	Lock

VN Unit as Slave

Using A1 to A6   Using H-51 to H-55 and A5

Switch Settings:

S1-2: Voltage or resistance inputs for A1 to A6

    OFF   =   Resistance   (for A5 active means linked to 0v)
    ON   =   Voltage (for A5 active means supplied with > 6.5v)

S1-3: Locked Slave/Locked Master

    OFF   =   Locked to Slave Defaults
    ON   =   Locked to Master Defaults

S1-7 & S1-8: Modbus Address

    S1-7 Off   S1-8 Off   = Invalid for slave unit.
    S1-7 Off   S1-8 On   = 1
    S1-7 On   S1-8 Don't Care = Address as set by C5 & C6

A standard Slave unit will accept **Hardware Inputs**

It will also accept values sent by a Standard Master unit if its address is in the range 1 to 15.

Lock function:

If any parameters are locked using the A6 /H-55 input then these parameters Will be locked to:-

The **Hardware Inputs** settings on the Slave if S1-3 is Off
The values from the Master if S1-3 is On

Input	A1/H-51	A2/H-52	A3/H-53	A4/H-54	A5	A6/H-55
Parameter	Not Used	Fan Speed	Mode	Not Used	On/Off	Lock

B9: AHU Mode
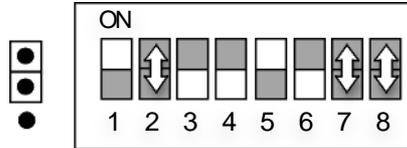
The AHU mode only supports a single Air Handling Unit.

Switch Settings

        S1-2 Off   =   Full Demand Control
        S1-2 On   =   0-10V Input Control

S1-7 & S1-8 : Modbus Address

S1-7 Off	S1-8 Off	= Invalid for AHU mode.
S1-7 Off	S1-8 On	= 1
S1-7 On	S1-8 Don't Care	= Address as set by C5 & C6

AHU 'DN' Codes

        The following settings need to be made to the 'DN' codes on the AHU.
        Code 6 = 0000   : Code 10   =   0006

Inputs:

        In this operating mode the RBC-TSI1 uses 3 of the analogue control inputs.
        (Inputs A3 and A5 operate as digital inputs)
        Input A1 is the 0-10V demand input (if used).
        Input A3 is a contact closure input : Open = Cool, Closed = Heat
        Input A5 is a contact closure enable input: Open = Off, Closed = On

Control Modes:

        Full demand control.
        This mode allows the AHU to run in full demand Heating or Cooling.
        Input A3 selects Heating or Cooling
        Input A5 enables or disables the unit.

        0-10V Input control.

        This mode allows the AHU power level to be set in 16 steps by setting the A1 input to a voltage from 0v (no demand) to 10v (full demand)
        Inputs A3 and A5 operate as in Full demand control.

Relays:

Relay 1 closes on defrost. Relay 2 closes on any fault.

Modbus:

The Modbus registers H0001, H0003 and H0005 have different functions in AHU mode as below.

H0001 :   Demand level (when SW1-2 is On)
                 0 to 1500 representing 0 to 15 power level.

H0003 :   0 = Cooling : 100 = Heating

H0005 :   0 = Off : 100 = On

H0002, H0004 and H0006 are unused.

H0001 and H0003 inputs operate on a 'Last Touch' basis together with A1 and A3

The Modbus input registers act as on the standard unit.

Appendix C: - Analogue Inputs

Analogue Input Settings

Set point, Lo-Set point, Hi_Set point, [Un]Occ SP, Occ SP Min, Occ SP Max

Resistance KΩ	<=0.4	1.1	1.8	2.5	3.2	3.9	4.6	5.4	6.1	6.8	7.5	8.2	8.9	9.6	>200
Voltage V	1.3	2.0	2.6	3.3	3.9	4.5	5.2	5.8	6.5	7.1	7.8	8.4	9.0	9.7	<1.0
SP (deg C)	18	19	20	21	22	23	24	25	26	27	28	29	30	31	*21

Mode, Fan Speed, Air Direction, [Un]Occ MD, Occ Fan speed, VN Mode,VN Fan speed, Lock

Resistance KΩ	<=1.1	2.2	3.3	4.7	6.8	9.6	15	>200
Voltage V	1-1.75	3.25	4.75	6.25	7.75	9.26	10.0	<1.0
FS	AUTO {0}	LOW {1}	MED {2}	HIGH {3}	HIGH {3}	HIGH {3}	HIGH {3}	*AUTO {0}
MD	AUTO {0}	HEAT {1}	FAN {2}	COOL {3}	DRY {4}	DRY {4}	DRY {4}	*AUTO {0}
AD	STOP {0}	Swing {1}	0 Deg {2}	22 Deg {3}	45 Deg {4}	68 Deg {5}	90 Deg {6}	*Swing {1}
Lock	SP, FS, MD,LV & IO {0}	SP,MD & IO {1}	MD & IO {2}	IO {3}	Local {4}	Unlock {5}	Unlock {5}	*Unlock {5}
VN-FS	LOW {1}	LOW {1}	HIGH {3}	HIGH {3}	HIGH {3}	HIGH {3}	HIGH {3}	*LOW {1}
VN-MD	AUTO {0}	Heat Exch. {5}	By-Pass {6}	By-Pass {6}	By-Pass {6}	By-Pass {6}	By-Pass {6}	*AUTO {0}

On/Off, Restart, Occ/Unocc

Resistance KΩ	>5.0	<1.0
Voltage V	<3.5	>6.5
I/O	*Off	On
Restart	*Idle	Active
Occupation	*Unoccupied	Occupied

* Indicates default value with open circuit input or < 1.0v

For details of which analogs relate to which parameters see information on individual operating modes (Appendix B)

Appendix D: - Modbus

Input Registers

Register	Units	Description
I0020	0..8	Number of units found
I0021	0..1	0 = No faults: 1 = 1 or more units in fault
I0022	0..65535	255 if No faults: First fault code
I0023	Deg C x 100	Average of all unit return air readings.
I0024		(Filter alarm – not implemented)
I0025	Deg C x 100	Minimum return air reading
I0026	Deg C x 100	Maximum return air reading
I0050	Deg C x 100	RC return air reading
I0052	0..1	0 = no RC: 1 = RC exists
For 'n'=1 to 8		
I0n20	0..1	Unit 'n' found
I0n21	0..1	Unit 'n' in fault
I0n22	0..65535	Unit 'n' fault code (or 255)
I0n23	Deg C x 100	Unit 'n' return air
I0n24		(Unit 'n' filter alarm – not implemented)
I0n30	0..2	Unit 'n' Thermo On
I0n31	Deg C x 100	Unit 'n' TC Coil temperature
I0n32	Deg c x 100	Unit 'n' TCj Coil temperature
I0n34	0..15	Unit 'n' Duty Cycle
I0n42	1..32	Unit 'n' Line address
I0n43	1..64	Unit 'n' Unit address

Holding Registers

Register	Units	Description
H0001	Deg C	Set point (Deg C)***
H0002	0..3	Fan Speed
H0003	0..4	Mode***
H0004	0..7	Louvre
H0005	0..1	On/Off
H0010	0..3	Update Mode (Global**)
H0011	0..3	Update Mode (Set Point)
H0012	0..3	Update Mode (Fan Speed)
H0013	0..3	Update Mode (Mode)
H0014	0..3	Update Mode (Louvre)
H0015	0..3	Update Mode (On /Off)
H0020	18..31	Set Point min (0 = No min limit)
H0021	18..31	Set Point max (0 = No max limit)
H0022	0..15	Fan inhibit mask *
H0023	0..31	Mode inhibit mask *
H0024	0..126	Louvre inhibit mask *
H0051 to		Hardware input values
H0059		See operating mode descriptions

***   See AHU mode details for the function in this mode
**   Writing to this register will put the same content in H0011 to H0015
*   To set inhibits add together the numbers for each feature to be inhibited.

	1	2	4	8	16	32	64
Fan Speed	Auto	Low	Med	High			
Mode	Auto	Heat	Fan	Cool	Dry		
Louvre		Swing	Horiz	22 Deg	45 Deg	68 Deg	90 Deg

e.g.   To restrict fan speed to Auto and Med
        Inhibit Low (2) and High(8)
        Set H0022 to [2 + 8] = 10

        To restrict the mode to Cool and Fan.
        Inhibit Auto (1), Heat (2) and Dry (16)
        Set H0023 to [1 + 2 + 16] = 19

        To restrict louvre to Horiz and 22 Deg
        Inhibit Swing (2), 45 Deg (16), 68 Deg (32) and 90 Deg (64)
        Set H0024 to [2 + 16 + 32 + 64] = 114

Additional Functions Available via Modbus

Lock Modes:

Input A6 (H-56) provides a facility to set combinations of update modes for the parameters as 'Locked' or 'Unlocked'.

If the A6 setting for any parameter is 'Unlocked' then it is possible via Modbus to change that setting to 'Locked', 'Local', 'Last Touch' or 'On Change'. In 'Locked' mode the unit will lock the appropriate button on the RC and force the parameter value to that stored in the RBC-TSI1.

In 'Local' mode the RBC-TSI1 will not send any values to the fan coil but will continue to provide Modbus access for monitoring purposes.

In 'Last Touch' mode the fan coil will respond to the last sent value from either the RC buttons, the Hardware Inputs or the Modbus registers.

'On Change' mode is similar to 'Last Touch' except that Modbus values will only be used if the value sent is different from the last value sent.

Note that the 'Locked ' mode is slightly different when set by A6 or H_55 as oppose to Modbus. If the mode is set by A6 or H-55 then the value is locked to the Hardware Inputs value. If it is set via Modbus H-10 to H-15 then the value is locked to the last value sent by the Hardware Inputs or the Modbus H-1 to H-5 registers.

Appendix E: - Fault Codes

Fault Codes:

Toshiba fault codes are designated with a single letter followed by a decimal value in the range 01 to 15.

The fault code values returned by the RBC-TSI1 may be converted into the equivalent Toshiba code as follows:-

1)   Convert the returned value into a 16-bit binary number.
2)   Separate this into the Upper and Lower bytes.
3)   The upper byte carries the ASCII value for the fault code letter.
4)   The lower byte carries the decimal number.

e.g.

Returned value 17682
1)   In 16-bit binary 17682 is '0100010100010010' (Hex 4512)
2)   Upper 8 bits (01000101), Lower 8 bits (00010010)
3)   01000101 (Hex 45, Decimal 69) is the ASCII value for 'E'
4)   00010010 (Hex 12, Decimal 18) Decimal number = 18
5)   Fault code is 'E18'

Note:-

A returned value of 255 indicates 'NO FAULT'

        A returned value of Zero indicates that the RBC-TSI1 is waiting for data.

Appendix F:- LED Information

LED Indications

'ON' (Amber):-
      Indicates that the unit is running.

'ERR' (Amber):-
      Indicates that the unit is in error.

'HVAC' (Green):-
      Flashes briefly on receipt of a message from the Air Conditioner

'485' (Green):-
      Normal -   Flashes briefly on transmission of a 485 message.
      Duty/Standby -   Indicates the Duty Master I/O state.

'ST1' to 'ST3' (Red, Blue, Amber):-
      Indicate unit status.

Status Indicators:-

Normal:-   ST2 pluses slowly

Error:-   ST1 alternates with ST2

Start-up sequence:-
      1:      HVAC, ST1, ST2, ST3 ,485 will scan up/down twice.
      2:      ST1 & ST3 will flash quickly. (Search phase)
      3:      ST2 will pulse slowly (Unit operational)

Appendix G:- Configuration Registers

The RBC-TSI1 has eight configuration registers referred to as C0 to C7
Each register holds a value between 0 and 15.
The values held in the configuration registers may be viewed and altered by Using the configuration routine below. In addition, the values held in C0 to C7 may be viewed in Modbus registers I-05 to I-12

Register Functions:

C0:   Sets the baud rate and parity for the RS485 link.
                     Baud rate choices are 4800, 9600 and 19200
                     Parity choices are NONE, EVEN and ODD

C1:   Sets the operating sense for the two relays.

C5 & C6:   Set the secondary Modbus address (selected by S1-7 = ON)

C7:   Forces a factory reset.

Configuration routine:

Power up the RBC-TSI1 with the switch settings as shown in (A).
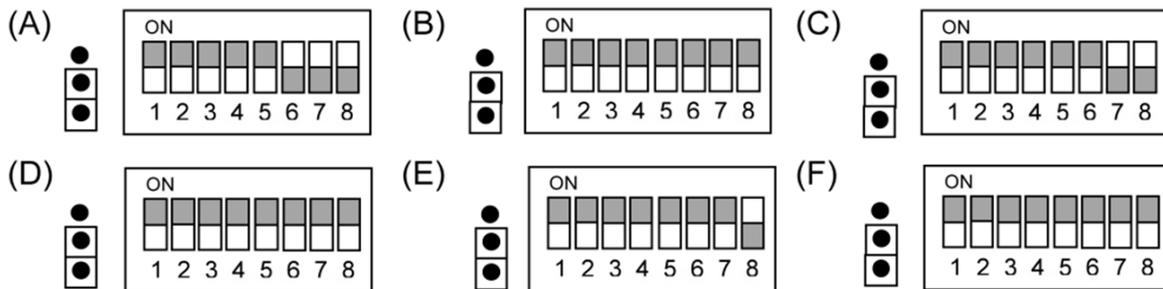
Follow the sequence (A) to (F) allowing approx. 1 second between changes.

At the end of the sequence the HVAC LED should be flashing rapidly.
In this state the configuration register number may be set as a binary number on switches S1-1 to S1-3 with S1-1 representing '4', S1-2 '2' and S1-3 '1'. For each selected register the four remaining LEDs will show the stored value in binary with *ST1* representing '8', *ST2* ''4', *ST3* '2' and *485* '1'
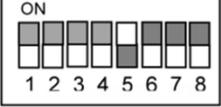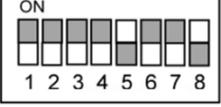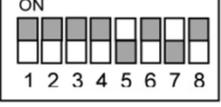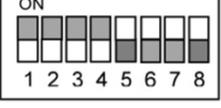To write a new value to a register first select the register number and then set the desired value in binary using S1-5 as '8', S1-6 '4', S1-7 '2' and S1-8 '1'. Finally toggle switch S1-4 On and then Off.
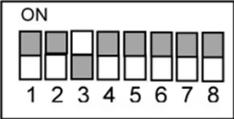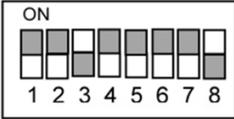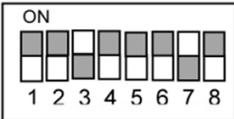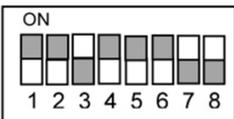The four LEDs should now be displaying the new value.

Following the configuration sequence power down the RBC-TSI1 , reset the switches to the required function settings and re-power the unit.

Configuration settings:

C0

Value		Baud Rate	Parity
0		4800	None
1		4800	Odd
2		4800	Even
4		9600	None
5		9600	Odd
6		9600	Even
8		19200	None
9		19200	Odd
10		19200	Even
15		9600	None
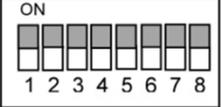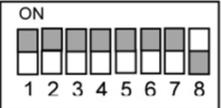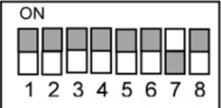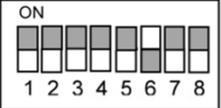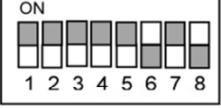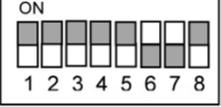
C1

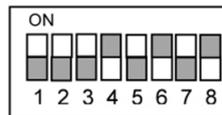| Switch Setting	Relay 1	Relay 2
ON 1 2 3 4 5 6 7 8	Non-Inverted	Non-Inverted
ON 1 2 3 4 5 6 7 8	Non-Inverted	Inverted
ON 1 2 3 4 5 6 7 8	Inverted	Non-Inverted
ON 1 2 3 4 5 6 7 8	Inverted	Inverted

C5 & C6

Set to specify the secondary Modbus address (= 16xC5 + C6).

Secondary address selected by switching S1-7

C7

Perform Factory Reset

Appendix H: - Firmware Upgrade

Firmware Upgrade.

Upgrading of the firmware requires a serial RS485 connection to the unit. This link must be capable of supporting 115,200 Baud.

The procedure for upgrade is as follows:

1.   Download the revised firmware upgrade 'BP_TSI1_FWnnn.exe' (where nnn is the version number).

2.   Connect the RS485 lead between the PC and the RBC-TSI1

3.   On later units (Ver 1.25 up) set S1-7 OFF and S1-8 ON then power the RBC-TSI1 and go directly to [10]. For earlier units (or if version unknown) continue to [4].

4.   On the RBC-TSI1 make the link (S2) and turn switches S1-1 and S1-2 both ON leaving all other switches OFF.

5.   Power up the RBC-TSI1.

6.   LEDs ST1 (Red) and ST2 (Blue) will illuminate.

7.   After a short period LED ST1 will extinguish.

8.   Switch OFF S1-1.

9.   LED ST1 will now be flashing and LED ST2 will be ON.

10.   Run BP_TSI1_FWnnn.exe selecting the correct serial port.

11.   The new firmware will install.

12.   Following installation power down the RBC-TSI1, set the switch and link settings for the required operational mode and re-power the unit.

Appendix J:- Revision History

Date	Document Ver	Firmware Ver	By	Comments
24/05/2016	v1.00	v1.19	jih	First version
16/09/2016	v1.01	v1.24	jih	Added AHU Mode Changed decals for link S2 Modified description of ECO Timed Fan Mode
26/10/2016	V1.02	V1.30	jih	Revised description of 'Hotel' mode Minor corrections
04/01/2017	V1.03	V1.32	jih	New 'Waft' fan mode feature in Appendix B5 (ECO Timed Fan Mode) Revised Appendix 'H'

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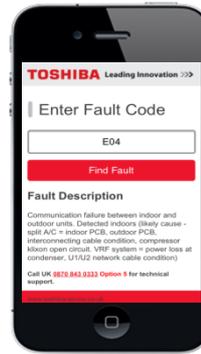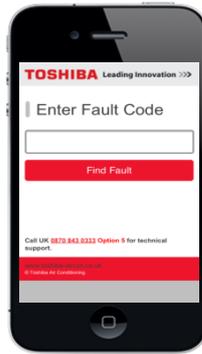
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