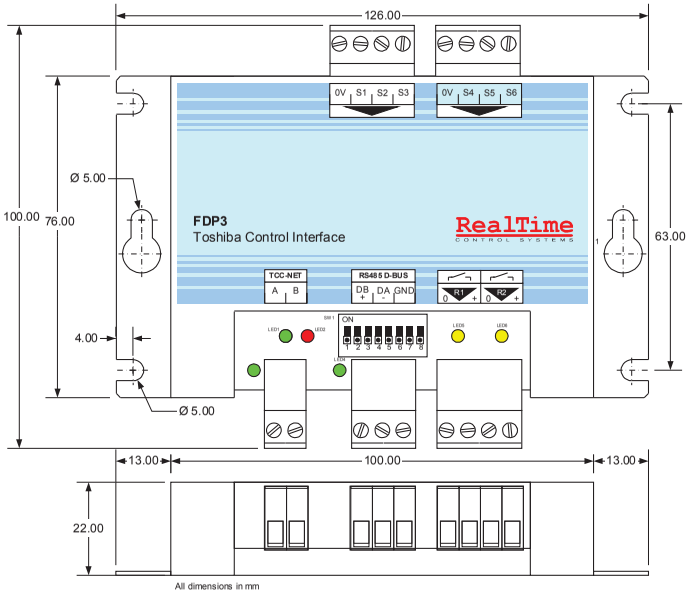
# FDP3 Toshiba Interface v1.02

Installation and Operating Instructions




## FDP3 Description

The FDP3 is a low cost monitoring and control interface for Toshiba VRF and Split ranges of air-conditioners. The interface is compatible with all units that have a TCC-NET A,B remote controller network connection. No other network adaptor cards are required even for split A/C units.

## Functions

HARDWIRED CONTROL. Unit control can be achieved through resistance inputs using potentiometer and volt-free contact inputs.

BMS INTEGRATION. Unit control can be achieved through 1-10V voltage inputs integrated with BMS control outputs.

REMOTE CONTROLLER Facility to individually lock and remote controller buttons associated with unit control.

RUN/FAULT Outputs. Readback of all indoor and outdoor unit fault codes and unit run status.

DUTY/STANDBY. Run/standby rotation with run on fault and programmable rotation period.

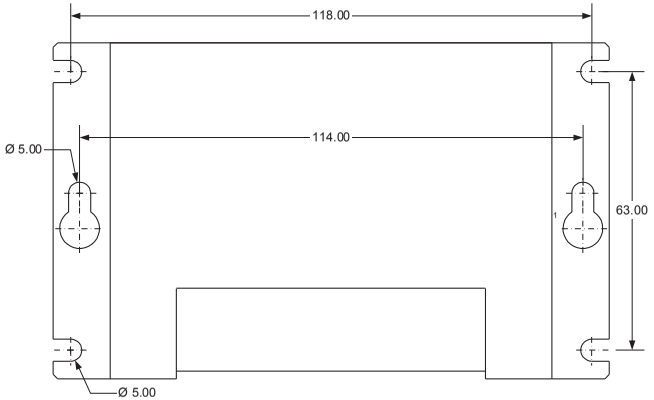
MODBUS. RS485 Modbus Control and Monitoring Functions.

## Warnings and Cautions

**Do not exceed the specified fault relay ratings**

**Observe precautions for handling Electrostatic Sensitive Devices**

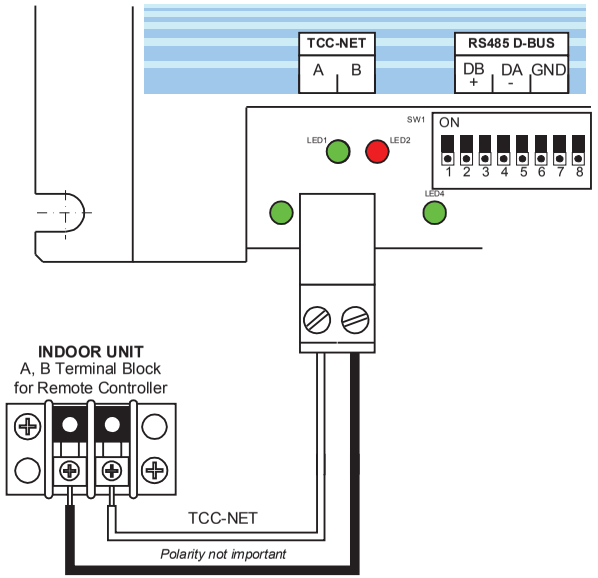
## Mounting




The FDP3-Modbus can be mounted horizontally or vertically.

## TCC-NET Network

TCC-NET Terminals A, B connect to the Toshiba TCC-NET remote controller network. The FDP3 is powered from this connection and communicates with the indoor unit on this network.. The FDP3 can be connected together with one Toshiba remote controller.




## FDP3 Standard BMS Mode

The FDP3 operates in Standard BMS Mode with SW1.1 in the OFF position.

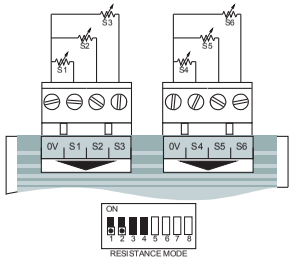

*FDP3 Configuration SwitchesSW1.1-SW1.8*

In Standard BMS Mode The FDP3 Inputs S1 to S6 allow individual control of various unit operating parameters. Each input corresponds to a specific unit setting shown in the table to the right. If an input is left unconnected then the corresponding setting will remain at a default value.

| | |
|---|---|
| **S1** | Setpoint |
| **S2** | Fanspeed |
| **S3** | Mode |
| **S4** | Louver |
| **S5** | On/Off |
| **S6** | Lock |

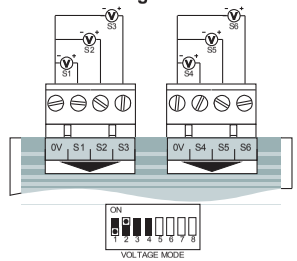
The configuration switch SW1.2 changes the inputs S1 to S6 between Resistance and Voltage modes.

### Resistance Mode




With SW1.2 OFF the inputs S1 to S6 operate in Resistance Mode, unit operation can be controlled by connecting fixed or variable resistors to inputs S1 to S6.

### Voltage Mode




With SW1.2 ON inputs S1 to S6 operate in Voltage Mode. Voltage ranges between 1V and 10V can be used to modulate each input. This mode is designed for interfacing the FDP3 to BMS voltage outputs.

Each control input has a defined control range under voltage and resistance mode as outlined in the following tables. Default settings are applied if the input remains unconnected. These are indicated in the table by the symbol ●.

| **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 | >200k |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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 |
| **S1 Setpoint** | **18** | **19** | **20** | **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** | **31** | **●21** |

| S2 Fanspeed | S3 Mode | S4 Louvre | S6 Lock | Resistance kΩ | Voltage V |
|---|---|---|---|---|---|
| **AUTO** | **AUTO** | **Stop** | **All** | <=1.1kΩ | 1 - 1.75V |
| **LOW** | **HEAT** | **Swing** | **S1,S3,S5** | 2.2kΩ | 3.25V |
| **MED** | **FAN** | **0 Degree** | **S3,S5** | 3.3kΩ | 4.75V |
| **HIGH** | **COOL** | **15 Degree** | **S5** | 4.7kΩ | 6.25V |
| **HIGH** | **DRY** | **45 Degree** | **Local** | 6.8kΩ | 7.75V |
| **HIGH** | **DRY** | **75 Degree** | **Unlock** | 9.6kΩ | 9.25V |
| **HIGH** | **DRY** | **90 Degree** | **Unlock** | 15kΩ | 10.00V |
| **●AUTO** | **●AUTO** | **●Swing** | **●Unlock** | >200kΩ | <1.00 |

| S5 On/Off | Resistance kΩ | Voltage V |
|---|---|---|
| **●OFF** | >5.Ω | <3.5V |
| **ON** | <1kΩ | >6.5V |

## FDP3 Standard Operation Inputs

When S6 is NOT operating in *Local* mode the inputs S1 to S5 allow control of the A/C unit operating parameters. The lock status of the input determines if the corresponding remote controller buttons are locked or unlocked.

If an input is locked then the remote controller button is locked and the input value on S1 to S5 will always be written to the unit. In the locked mode the input will also override central controller operation.

If the input is not locked then the input will operate in a *last-touched* mode with the remote controller in which updates from the input will only be written when a change occurs.

When input S6 is configured in *Local* mode then the A/C unit operates stand-alone and inputs S1 to S5 will not affect the operation of the unit.

### FDP3 Standard Operation Outputs

The FDP3 has two output relays (maximum rating 1A 24VDC, / 30VAC). The relays outputs are configured as follows:

| Output | Name | Operation |
|---|---|---|
| R1 | Run | A/C Unit Operation |
| R2 | Fault | Closed on any unit fault |

Using advanced configuration it is possible to change relay functionality and invert operation.

## FDP3 Group Control

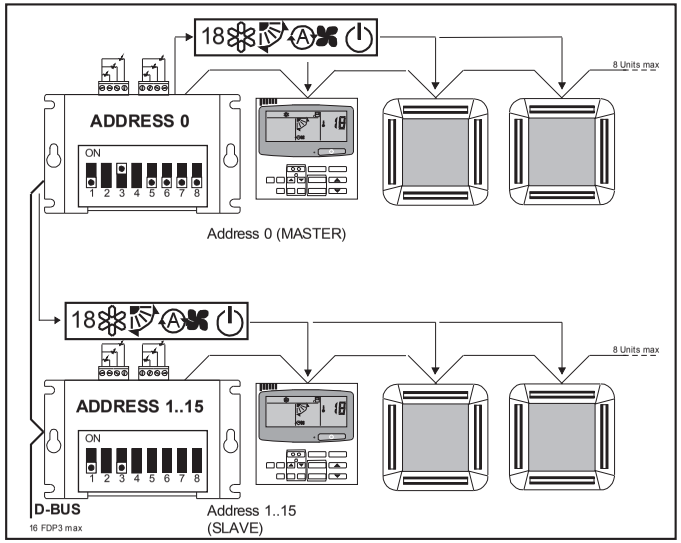
Connecting additional FDP3 controllers as slaves allows larger groups of units to be controlled from the master. Setting SW1.3 ON on FDP3 Address 0 (Master) causes the settings of the Master to be written to Addresses 1 to 15 (Slaves). The position of SW1.3 on the Slaves determines if the Slave operate in Locally Locked or Centrally Locked mode.

Note that in Group Control mode it is not possible to attach an external Modbus Master to the network.

## Local Locked Group Control

A Slave FDP3 configured with SW1.3 OFF will operate in Locked Slave Group Control. Input S6 on each FDP3 determines the local Lock state of the device. When inputs are locked then the local S1 to S5 input values will be written to the A/C units and the corresponding remote controller buttons will be locked.

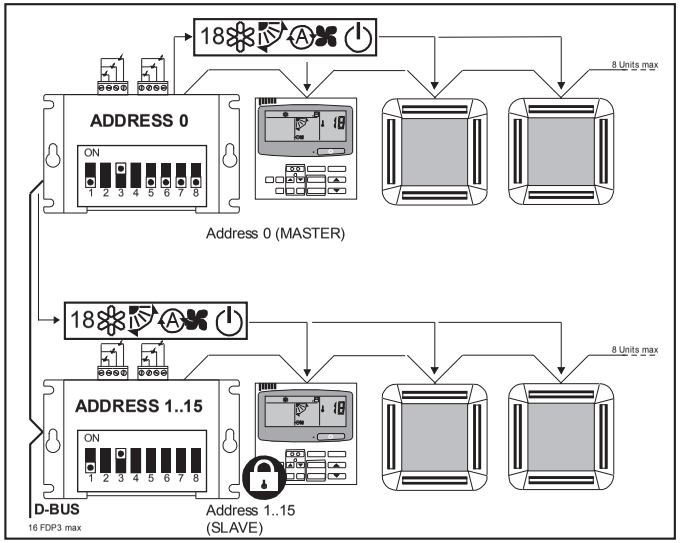
If an input is configured as *Last Touched* mode by input S6 then the unit operation is determined by the Remote Controller, or a change to an Input on either the Slave or the Master device.




## Central Locked Group Control

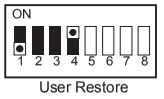
A Slave FDP3 configured with SW1.3 ON will operate in Locked Master Group Control. Input S6 on each FDP3 determines the local Lock state of the device. When inputs are locked then the control value from the Group Master will be written to the A/C units and the corresponding remote controller button will be locked.

If an input is configured as *Last Touched* mode by input S6 then the unit operation is determined by the Remote Controller, or a change to an Input on either the Slave or the Master device.

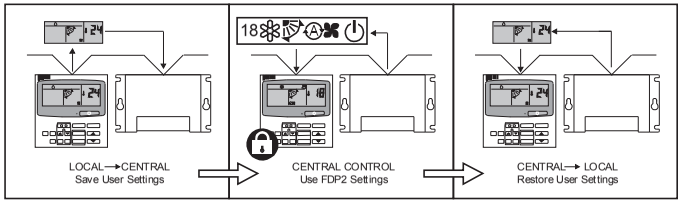



## Local Restore BMS Mode SW1.4

SW1.4 enables Local Restore Mode on master and slave FDP3. In this mode the remote controller settings are saved when the FDP2 enters central/locked operation. When the remote controller returns to local operation the saved settings are restored to the remote controller.

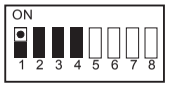



Local Restore operation is shown in the following figure.



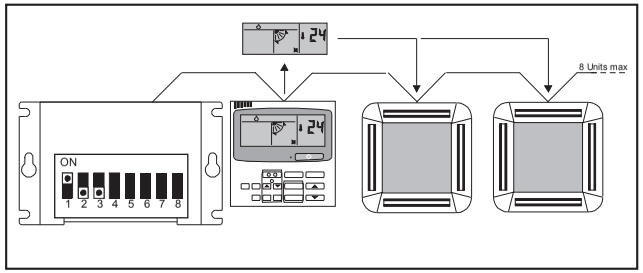
## Preset Operating Modes

With SW1.1 set to ON configures the FDP3 to operate in a number of preset modes*. In this mode of operation the inputs S1 to S6 are not used for control.

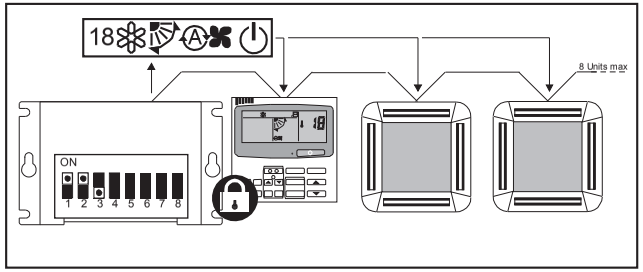


*FDP3 Configuration SwitchesSW1.1-SW1.8*

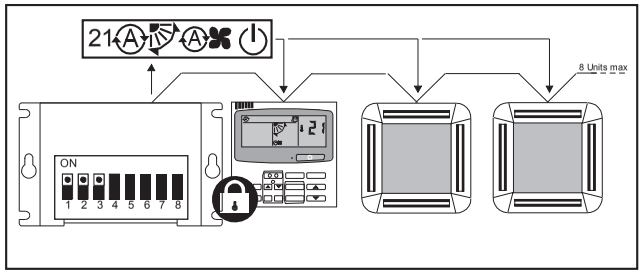
### Unlocked Operation



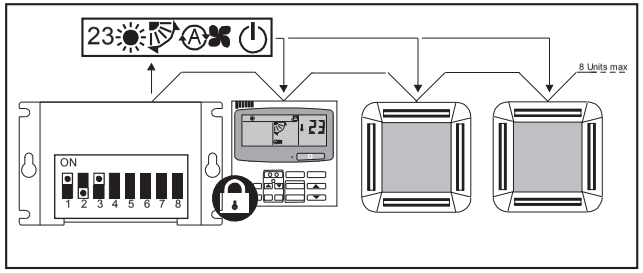

### Locked Cooling Preset




### Locked Auto Preset

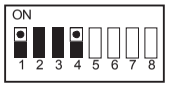



### Locked Heating Preset




*Units that do not support specific modes such as cooling-only units will operate in fan-only in unsupported modes.

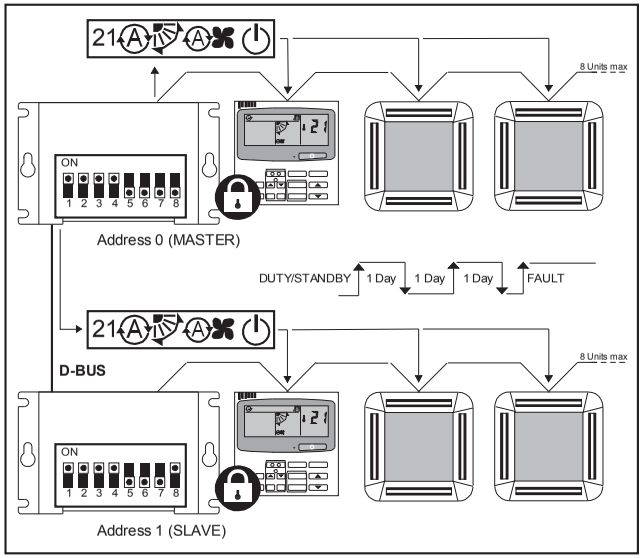
## Duty/Standby Operation



*FDP3 Configuration SwitchesSW1.1-SW1.8*

Duty/Standby will alternately run two systems on alternating run/standby rotation. If a fault occurs on either system then both systems are switched on until the fault is cleared. The default rotation period is 24 hours, alternative rotation periods can be selected by linking inputs S1 to S6.

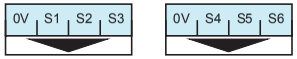
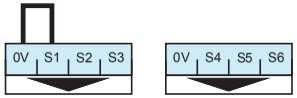
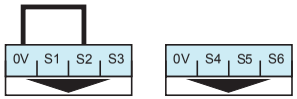
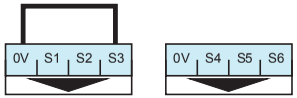
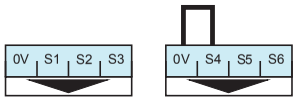
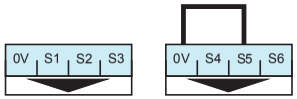
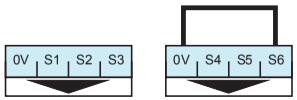
Duty/Standby is achieved using two FDP3 devices, one with Address 0 and one with Address 1 with a D-BUS connection between the two. SW1.1 and SW1.4 must be switched ON on both devices to enable the operation.




The MASTER FDP3 can be configured using SW1.2 and SW1.3 to operate using one of the three preset modes Heat, Cool or Auto. Alternatively the MASTER can be configured for local control, in which case the remote controller attached to the MASTER FDP3 can be used to set the operating settings during master duty.

## Duty/Standby Rotation Period

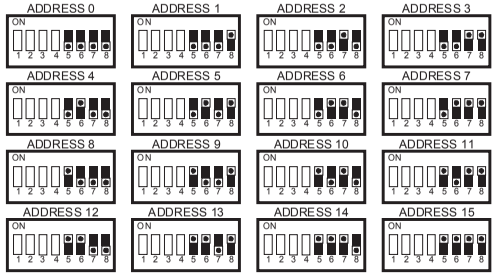
The default rotation period is 1 Day. Alternative rotation periods can be selected by linking the FDP3 inputs as shown in the table below. Note that the 1 Minute rotation period is for commissioning purposes only and should not be used for long term unit operation.

| Configuration | Rotation Period |
|---|---|
|  | 1 Day *(default)* |
|  | 1 Minute *(temporary operation only)* |
|  | 60 Minute |
|  | 6 Hour |
|  | 2 Days |
|  | 1 Week |
|  | 2 Week |

## FDP3 Networking

ADDRESSING

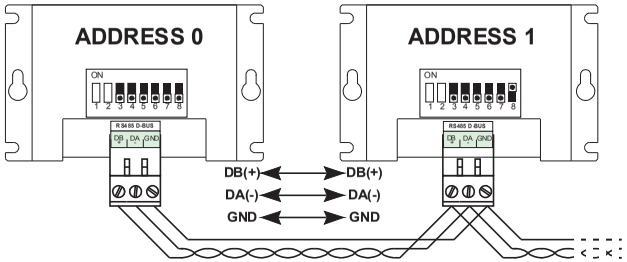
The FDP3 has the facility to create control groups using multiple FDP3s connected together on the RS485 D-Bus network. In standard configuration up to 16 FDP3 devices can be connected together. Each FDP3 is assigned a D-Bus address using the configuration switches SW1.5 to SW1.8. Unit addresses are shown below.




Address 0 is the FDP3 MASTER address. Address 1 to 15 are FDP3 SLAVE addresses.

NETWORK INSTALLATION

The RS485 D-Bus network requires a twisted pair cable connecting terminals DB(+) and DA(-) on each FDP3 as shown below. 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. The network must be installed as a daisy-chained point-to-point Bus configuration, Star and Ring connections must NOT be used.




SPECIFICATION

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.

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.

# Modbus Operation

CONTROL

The FDP3 can be operated from both the hard-wired inputs and Modbus register commands if input S6 is open-circuit. Under this mode of operation control updates will be sent if a change is made to either a Modbus register or a wired input. All control registers are analogue **Holding Registers**

| Holding Register | Name | Range |
|---|---|---|
| H0001 | Setpoint | 10..40 |
| H0002 | Fanspeed | 0..3 (0:Auto, 1:Low, 2:Medium, 3: High) |
| H0003 | Mode | 0..4 (0:Auto, 1:Heat, 2:Fan, 3:Cool, 4:Dry) |
| H0004 | Louvre | 1..7 (1:Swing, 2: 0 Degrees, 3: 20 Degrees, 4:45 Degreees, 5:70 Degrees, 6:90 Degrees ) |
| H0005 | OnOff | 0..1 (0:Off, 1:On) |

| Holding Register | Name | Lock Mode* |
|---|---|---|
| 0010 | All Lock | 0:LastTouch,1:Central,2:Local,3:OnChange |
| 0011 | Setpoint Lock | 0:LastTouch,1:Central,2:Local,3:OnChange |
| 0012 | Fanspeed Lock | 0:LastTouch,1:Central,2:Local,3:OnChange |
| 0013 | Mode Lock | 0:LastTouch,1:Central,2:Local,3:OnChange |
| 0014 | Louvre Lock | 0:LastTouch,1:Central,2:Local,3:OnChange |
| 0015 | OnOff Lock | 0:LastTouch,1:Central,2:Local,3:OnChange |

*__Last Touch__ updates are written to the A/C on every register write. __On Change__ updates are only sent if the value written changes. __Central__ locks the corresponding RC button. __Local__ unlocks the RC button and prevents any updates from the FDP3.

MONITORING

Unit data is available for each of the indoor units on the TCC-NET network. All readback data is available in analogue **Input Registers**. Input registers are numbered using the indoor unit number x 100 added to an offset relating to a specific feature. Group data is available as unit 0.

| Group* | Unit 1 | Unit 2 | ... | Unit16 | Name | Range |
|---|---|---|---|---|---|---|
| 0020 | 0120 | 0220 | ... | 1620 | Unit Exists | 0..1 |
| 0021 | 0121 | 0221 | ... | 1621 | Is Fault | 0..1 |
| 0022 | 0122 | 0222 | ... | 1622 | Fault Code | 0..65535 |
| 0023 | 0123 | 0223 | ... | 1623 | Return Air Temp | Degrees C x 100 |

* Group **Unit Exists** returns the number of units found. Group **Fault Code** returns the fault code of the first unit in fault. **Group Return Air Temp** returns the average unit temperature.

FAULT CODES

Fault codes are encoded using a standard table to allow standard Toshiba fault codes to be generated from the readback value. The **no fault** value is 255.

KEYPAD LOCK

When the keypad is locked using input S6 then Modbus commands will not change the lock state but unit settings can still be adjusted. When the S6 input is set to unlock the keypad then Modbus commands can change the lock state.

*Additional Modbus registers and more detailed Modbus engineering instructions are available in the **FDP3-Modbus** datasheet. available from **http://www.realtime-controls.co.uk/FDP3.** A full list of fault codes is also available from this link.*

# LED Functionality

Key: ○ OFF ✳ FLASHING ✳ ON

### Normal Operation

| | |
|---|---|
| R ✳ ✳ ✳ ✳ ✳ ○<br>G ✳ ✳ ✳ ✳ ✳ ○ | Power-Up sequence Factory Configuration |
| R ✳ ○ ✳ ○ ✳ ○<br>G ✳ ✳ ✳ ✳ ✳ ○ | Power-Up sequence Custom Configuration |
| R ○<br>G ✳ | TCC-NET Search. After power-up and during unit configuration |

| | |
|---|---|
| R ○<br>G ✳ | No Fault State |
| R ✳<br>G ○ | Unit Fault |

### Error Conditions

| | |
|---|---|
| R ○ ✳ ○ ✳ ○ ✳ ○ ✳ ○ ✳<br>G ○ ✳ ○ ✳ ○ ✳ ○ ✳ ○ ✳ | Device configuration error |
| R ✳<br>G ✳ | AC Unit Missing |
| R ✳<br>G ✳ | RS485 Communications Timeout |

S1 to S6 cables should be 0.5 to 1.0 mm2 multi-stranded screened twisted pair. The screen should be earthed at one end only. The maximum distance from the FDP2 to the input source is 200m.

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.

It is recommended that volt-free contacts or switch mechanisms connected to S4, S5 and S6 have gold plated contacts to ensure a low resistance circuit when the switch is made.

# Functional Specification

**Electrical**

| | |
|---|---|
| **Supply** | 15V-24V DC, 50mA |
| **Power** | <1.2VA |
| **Relay** | 1A, 24VAC max<br>1A, 30VDC max |

**Mechanical**

| | |
|---|---|
| **Dimensions** | H100 x W100 x D22 mm |
| **Mounting** | 2 / 4 screw |
| **Casing** | Zinc coated mild steel |
| **Weight** | 120g |
| **Connectors** | Rising clamp to 0.75mm$^2$ cable |

**Environmental**

| | |
|---|---|
| **Temperature** | |
| **Storage** | -10°C to 50°C |
| **Operation** | 0°C to 50°C |
| **Humidity** | 0-90% RH non-condensing |
| **Protection** | IP30 |
| **EMC Emissions** | EN61000-6-1 |
| **EMC Immunity** | EN61000-6-3 |

**Inputs**

| | |
|---|---|
| **Voltage Mode** | S1..S6 0..10VDC <1mA |
| **Resistance Mode** | S1..S6 5V, 1mA |