## INSTRUCTION AND PROGRAMMING MANUAL

## Techtrol Signal Convertor - 'TSC'

It is a microcontroller based signal convertor used for converting input signals to MODBUS RTU RS485 to enable it as an interface with the 'HOST'. This host being master could be PLC/SCADA or IIoT Gateway.
Two types of Techtrol signal convertors are available as under.

1. TSC-D is used in conjunction with any switch having potential free or PNP outputs. Max 4 inputs can be connected.
2. TSC-A is used in conjunction with 2 wire or 4 wire transmitter of any parameter having $4-20 \mathrm{~mA}$ analog output.


ABS IP65 Enclosure TSC- A or D


Cast Al Ex- d IIB Enclosure
TSC- D or A

## Pre - I nstallation Check

1. Ensure that convertor is not damaged in transit.
2. Ensure that supplied goods are in accordance with the requirement. CAUTION

It is recommended to employ qualified, experienced personnel who are well versed with instrumentation to appreciate the instructions and follow them meticulously to avoid any malfunctioning \& damages.

## Precaution before I nstallation

## During installation, please ensure...

- Mounting location is away from high voltage cables and contactors.
- The ambient temperature around mounting location should be maintained below $50{ }^{\circ} \mathrm{C}$
- Ensure the mounting location is not close to flammable objects, free from excess humidity, acid gases and vibrations.
- Mounting surface should be flat and without vibrations.


## I nstallation

- The convertor is available in wall mounting with IP65 protection or Ex-proof Gr IIB protection.
- Drill holes at appropriate location. Mount the convertor on identified location and secure it on four mounting hole. (refer mounting details)


## Mounting Details



## Termination and Wiring

- While wiring, supply should be kept off for human safety \& prevention of accidents.
- Connect 230 VAC to 'Supply' terminals of convertor. In case of 24 VDC supply, ensure correct polarity.
- TSC-D \& TSC-A are provided with auxiliary output of 24 VDC @ 50 mA . This supply can be used with potential free switching inputs or to provide power to transmitters.
- Maximum four switching inputs can be connected to TSC-D at '+', L1, L2, L3 \& L4 terminals respectively by using auxiliary 24 VDC output (Refer fig 1). Use ' + ' as common terminal.
- In case of PNP input, use external 24 VDC supply. Refer fig. 2
- Transmitter ( $\mathbf{2}$ wire) is connected to TSC-A by using internal 24 VDC auxiliary supply. Single
current input can be connected. (Refer fig 3).
- Use external 24 VDC supply of appropriate power rating for 4 wire transmitter, refer fig 4.
- Total 7 no. of slaves are recommended to be connected in daisy chain manner as shown in fig 5.
- For end slave DIP 2 switch ON (optional).

Fig 1. TSC-D: Switch I/P using Internal 24 VDC O/P


Fig 3. TSC-A: Transmitter 2 wire I/P using Int. Aux. Supply


Fig 2. TSC-D: PNP Switch I/P using Ext. Supply


Fig 4. TSC-A: Transmitter 4 wire I/P using External Supply


Fig 5. Connection of Slaves in Daisy Chain Manner


## Precautions

- Ensure convertor is duly earthed and located in areas having ambient temperature $<50^{\circ} \mathrm{C}$.
- While wiring, supply should be kept off for human safety and prevention of accidents.
- Wiring should run away from high voltage cables, contactors and inductive loads.
- Ensure the power rating of external 24 VDC supply is sufficient for PNP switch input load/ 4 wire transmitter
- Tighten all the terminals firmly so that wire connection should not remain loose.
- Before switching on supply, ensure wiring is correct and completed.
- Ensure enclosure is closed with its cover \& gasket. There should be no gap between cable OD and cable gland ID after wiring.


## LED I ndications

Open the enclosure cover and find LEDs on PCB.

## 1) $T S C-D$

- Green color LED is for power supply
- Red colored LED (2 nos) near to power supply LED indicates Tx \& Rx which flashes during transmission and reception
- Four red colored LEDs L1, L2, L3 \& L4 are for switching inputs. Each LED glows when respective switch input is ON.

2) TSC-A

- Green color LED is for power supply.
- Red colored LED (2 nos.) near to power supply LED indicates Tx \& Rx which flashes during transmission and reception


## DI P Switch Settings

- Refer attached protocol document for DIP switch setting.

1) TSC-D

- DIP $1 \& 2$ is for selection of baud rate.
- DIP 3, $4 \& 5$ for setting a slave address.
- When input contacts are bi-stable/ holding contacts (suitable Techtrol Model DS, CNS, CPS, FGSO/SI where no. of float = no of levels). DIP 6, 7 \& 8 should be OFF.
- In case of float guided switch with single float or mono-stable/ momentary switching input contacts,
- If DIP 6, 7 \& 8 are in OFF condition, the response of the unit will show hex data as 0001, 0010,

0100, or 1000 according to float position at respective set pt. For the float position uncertain to the set point response will be 0000 .

- Combination of 6, $7 \& 8$ DIP switches are used according to set criticality of the level set point e.g. In case of FGS with single float having L1 level as critical level. Set the DIP switch position of $6,7 \& 8$ as $001(\mathbf{0}=$ Off Position and $\mathbf{1}=0 n$ position). On first time power on or in case of the power failed and resumption (irrespective of the data being shown in the MODBUS response before power failure), the response of the unit will show 0001 data, until any confirm set point cross over happens, after which the data of the response will follow its usual pattern depending upon the float movements across all the set points. Similarly this critical level can be any between L1 to L4 and you can set DIP switch accordingly.

DIP switch setting used for FGS with single float $x$ multiple levels

| DIP switch <br> Position of <br> $6,7 \& 8$ | Response data in hex when <br> power Off - On condition |
| :--- | :--- |
| 000 | As per float position w.r.t to set pt data <br> in hex as 0000,0001,0010,0100,1000 |
| 001 | First Level L1 On (0001) |
| 010 | Second level L2 On (0010) |
| 011 | Third Level L3 On (0100) |
| 100 | Fourth Level L4 On (1000) |
| 101 | NA |
| 110 | NA |
| 111 | NA |


| DIP switch <br> Position of <br> $6,7 \& 8$ | Actuated I/P | Response <br> data in hex |
| :---: | :--- | :--- |
| 000 | None | 0000 |
|  | L1 | 0001 |
|  | L1, L2 | 0011 |
|  | L1, L2, L3 | 0111 |
|  | L1, L2, L3, L4 | 1111 |

## 1) TSC-A

Refer attached protocol document for DIP switch setting.

- DIP 1, 2 \& 3 are for selection of Baud Rate
- DIP 4, 5 \& 6 are for setting a Slave Address
- DIP 7 \& 8 not applicable

| SL | Problem | Cause | Solution |
| :---: | :---: | :---: | :---: |
| 1 | No communication | 1. Wrong or loose connection <br> 2. Wrong setting of baud rate \& slave address <br> 3. Wrong communication port selected | 1. Check \& correct RS 485 connections as shown in fig $1,2 \& 3$ <br> 2. Check \& correct the setting, refer protocol details for DIP switch setting <br> 3. Check and correct the selection of communication port. |
| 2 | Switch LED does not glow in TSC-D | 1. Wrong connection <br> 2. Switch faulty <br> 3. Check external power supply rating in case of PNP SW I/P | 1. Check and correct the wiring of switch I/P <br> 2. Check switch operation or replace it <br> 3. Check the max load of PNP switch and connect it through supply of correct rating |
| 3. | Showing wrong Counts in TSCA | 1. Check the $0 / \mathrm{p}$ of the transmitter and its calibration | 1. Calibrate the transmitter, ensure its $0 / p$ is $4-20 \mathrm{~mA}$. <br> 2. If the problem still persist, consult factory |
| 4. | Convertor does not work | 1. Wrong power supply <br> 2. Wrong polarity in case of 24 VDC power supply | 1. If power supply LED is Off, check and connect correct power supply voltage. <br> 2. Connect supply with correct polarity |

## PROTOCOL DOCUMENT FOR TSC-D

## Introduction

The communication between Host \& TSC-D (Switch to RS485 converter) is done on a standard RS485 as a physical layer. The data link layer is RTU Modbus and the function code implemented is; Function code 01: Read discrete input.

## Query \& Response Pattern:

| Query <br> Byte <br> No. | Query | Response <br> Byte No | Response |
| :---: | :--- | :---: | :--- |
| 1 | Slave Address | 1 | Slave Address |
| 2 | Function Code | 2 | Function Code |
| 3 | HO Start Address | 3 | Byte Count |
| 4 | LO Start Address | 4 | HO first register <br> data |
| 5 | HO No. of <br> registers | 5 | LO first register <br> data |
| 6 | LO No. of registers | 6 | HO CRC -16 |
| 7 | HO CRC-16 | 7 | LO CRC -16 |
| 8 | LO CRC-16 | 8 |  |

DI P Switch Settings

\left.|  | Switch Position |  |
| :--- | :---: | :--- |
| MSB | 1 | Baud Rate |
| Selection |  |  |$\right\}$

## A) Baud Rate

|  | DIP S/W <br> ON | Baud Rate |
| :--- | :---: | :---: |
| MSB | 1 | 9600 |
|  | 2 | 19200 |
|  | 3 | 38400 |

## Note -

## B) Slave Address

| DIP Switch <br> $4,5,6$ | Slave Address <br> (In Decimal No) |
| :---: | :---: |
| $0,0,1$ | 1 |
| $0,1,0$ | 2 |
| $0,1,1$ | 3 |
| $1,0,0$ | 4 |
| $1,0,1$ | 5 |
| $1,1,0$ | 6 |
| $1,1,1$ | 7 |

- Total 7 nos. combinations of slave address are possible
- For end slave DIP 2 switch ON (optional).
- To change Slave ID \& Baud Rate, switch off the unit, change the DIP switch position and turn on the supply.


## PROTOCOL DOCUMENT FOR TSC-A

## Introduction

The communication between Host \& TSC-A ( $4-20 \mathrm{~mA}$ to RS485 converter) is done on a standard RS485 as a physical layer. The data link layer is RTU Modbus and the function code implemented is; Function code 03: Read Input Register.

## Query \& Response Pattern:

| Query <br> Byte No. | Query | Response Byte <br> No | Response |
| :---: | :--- | :---: | :--- |
| 1 | Slave Address (AA) | 1 | Slave Address (AA) |
| 2 | Function Code (03) | 2 | Function Code (03) |
| 3 | HO Start Address (00) | 3 | Byte Count (02) |
| 4 | LO Start Address (00) | 4 | HO first register data (DD) |
| 5 | HO No. of registers (00) | 5 | LO first register data (EE) |
| 6 | LO No. of registers (01) | 6 | HO CRC - 16 (FF) |
| 7 | HO CRC-16 (BB) | 7 | LO CRC -16 (GG) |
| 8 | LO CRC-16 (CC) | 8 |  |

## Remarks

1) 'AA' is single byte salve address, which is variable from 1 to 7 depending upon DIP switch position as given below.
2) 'BBCC' are two byte CRC on Query side. It is variable depending upon Query bytes 1 to 6 .
3) 'DDEE' are two byte sensor data on Response side which is variable from 0-4095 proportionally to the $4-20 \mathrm{~mA}$ input to the unit.
4) 'FFGG' are two byte CRC on Response side. It is variable depending upon Response bytes 1 to 5.

## DI P Switch Setting

|  | Switch Position |  |
| :--- | :---: | :--- |
| MSB | 1 | Baud Rate Selection |
|  | 2 |  |
|  | 3 | Slave ID Selection |
|  | 4 |  |
|  | 5 | NA |
|  | 6 |  |
|  | 7 |  |
|  | 8 |  |

## A) Baud Rate

|  | DIP S/W ON | Baud Rate |
| :--- | :---: | :--- |
| MSB | 1 | 9600 |
|  | 2 | 19200 |
|  | 3 | 38400 |

B) Slave Address

| DIP Switch 4, <br> 5,6 | Slave Address <br> (In Decimal No) |
| :---: | :---: |
| $0,0,1$ | 1 |
| $0,1,0$ | 2 |
| $0,1,1$ | 3 |
| $1,0,0$ | 4 |
| $1,0,1$ | 5 |
| $1,1,0$ | 6 |
| $1,1,1$ | 7 |

## Note:

- Total 7 nos. combinations of slave address are possible
- For end slave DIP 2 switch ON (optional).
- To change Slave ID \& Baud Rate, switch off the unit, change the DIP switch position and turn on the supply.

