INSTRUCTION & MAINTENANCE MANUAL

Techtrol Universal Indicator Controller – TUIC



Every Techtrol product should be installed properly, maintained regularly and used within its specified limits to ensure accurate & trouble free performance with extended working life.

Introduction 1.



Wall Mounted IP66 or Ex d IIB

TUIC is a programmable indicator and controller, it is used in conjunction with 2 wire or 4 wire transmitter having 4-20 mA output for remote indication and control. It is available in panel mounted or wall mounted type. Various parameters can be programmed through four keys, provided on front bezel. Its four inbuilt relays can be independently programmed for set and reset values. Potential free contacts of the relay can be used further for alarm generation or automatic start –stop of pump and solenoid valves. In addition, re-transmission output is provided for further connection to PLC and RS-485 Modbus RTU for serial communication.

It is calibrated at factory for 4-20 mA input and need not require calibration on field; however, if required, TUIC can be easily calibrated though keypad.

2. **Pre-installation Check**

- Ensure that no physical damage is caused to TUIC, due to incorrect handling during transit.
- Wire TUIC as per wiring diagram (fig 3)
- Connect transmitter / calibrator output (4-20 mA) to I/P terminals of TUIC with multi-meter in series.
- Switch on the supply. Observe initializing message on TUIC.
- At an input of 4 mA, TUIC will display lowest value of measuring range.
- Gradually, increase the input from 4 to 20 mA and observe increase in displayed value to its max. range at 20 mA.

3. Installation

During installation, please ensure following:

- Mounting location should be away from high voltage cables and contactors.
- The ambient temperature around location should be maintained below 60°C
- Use sun shield to protect LCD & electronics of TUIC from direct sunlight.

Panel Mounted Type (Fig 1) –

Prepare 92 x 92 mm cutout on panel at required location and mount the TUIC from front and secure it in place through fixing clamps.

Enclosure Size: 96 x 96 x 150 (D) mm

Wall Mounted Type (fig 2) -

Mounting surface should be flat and without vibrations. Drill holes at appropriate locations. Mount TUIC on identified location and secure it on four screws.

Enclosure Size: 275 x 185 x 175 (H) mm

Termination and Wiring 4.



FRONT VIEW

Fig 1. Panel Mounted.





- While wiring, supply should be kept off for human safety & prevention of accidents.
- Connect 230 VAC to supply terminals of TUIC. In case of 24 VDC, ensure correct polarity.
- Connect transmitter output to input terminals of TUIC. Note that current sensing resister at input of TUIC is of 3.3 Ohms
- Whenever re-transmission is provided, it is isolated type.
- Refer figure 3 & 5 for re-transmission and figure 4 & 6 for RS-485 terminations for panel & wall mounted type.



Fig 3. Panel Mounted x 4-20mA Re- Tx O/P



Fig 4. Panel Mounted x RS485 O/P



Fig 5. Wall Mounted x 4-20 Re-Tx O/P

Fig 6. Wall Mounted x RS-485 O/P

- Ensure TUIC is duly earthed and located in areas having ambient temperature < 60°C.
- Wiring should run away from high voltage cables, contactors and inductive loads.
- Before switching on supply, ensure wiring is correct and completed as per termination & wiring diagram.
- Use suitable snubber in case of inductive load across contactor/relay coil

5. Programming

TUIC is programmed for various parameters through four keys on front panel in conjunction with display. Correct programming is essential for obtaining accuracy and reliable performance and control.

Modes of operation

Program Mode: In this mode, user can program the unit for device set points, Configure device, Strap, Input Calibration etc....

Run Mode: In this mode, unit will be ON and reads the level and volume in respective units.



Run Mode Display

Key Functions



'Function' (F) Key to enter in programming mode or to exit from programming menu.



'Enter' (ENT) Key to enter in next submenu or Save the changes.



'SHIFT' Key to shift cursor to left digit

'Increment' (INC) Key to increase digit value while parameter setting or go to next submenu



Programming Flow Chart



You can enter in menu using 'Enter' key







Mode 1: Setting of Level Range, Bottom Offset, Max Strap Count, Strap Interval and Level Value corresponding to Re-transmission Output.

It indicates Level Range to be measured and displayed. User can set it between 00000 to 99999 by using INC & SHIFT key. To modify parameter, it asks for password. **Enter 119 as password to change parameter value. This is common to all menus.**

It indicates Bottom Offset.

User can set offset either positive (+ve) or negative (-ve), using INC & SHIFT keys.

It indicates Bottom Offset Value. User can set bottom offset from 0000 to 9999, using INC & SHIFT keys.

It indicates Maximum Strap Count. For conversion of level to volume, total level range is divided into no. of straps, if volume is required to be measured. More the strap counts, more accurate is the volume reading. User can set it from 2 to 1200 using INC & SHIFT keys.

Based on number of counts, strap step interval is decided. User can set the strap step interval value here using INC & SHIFT keys.

User can set the value of level for which re-transmission output will be 4 mA using INC & SHIFT keys.

User can set the value of level for which re-transmission output will be 20 mA using INC & SHIFT keys.

Note:

- 1. +ve bottom offset is used to display bottom dead band, hence 4 mA readings starts from bottom offset value.
- -ve bottom offset is used when TUIC is used alongwith FGT, as FGT is factory calibrated, its 4-20mA settings cannot be modified on site. With -ve bottom offset, level against 4 mA (x) can be shifted to (x+y) level and display read zero (0) or lowest value from that level point (x +y).



Menu 2 – Setting Units, Tank No, Salve Address, Baud Rate.

It indicates 'Level Unit'. User can set as given under mm, cm, meter, percentage (%) using SHIFT key.

It indicates 'Volume Unit'. User can set one of given i.e. Liter, KL, gal, Ton, percentage (%). Using SHIFT key.

It indicates 'Tank Number'. User can set tank number from 01 to 99 by using INC & SHIFT keys.

It indicates 'Slave Address' which is used for RS-485 communication. User can set it from 001 to 255 by using INC & SHIFT keys

It indicates 'Baud Rate' setting. User can select between 1200, 2400, 4800, 9600 kbps using INC & SHIFT key



Menu 3 – Set & reset value configuration of relays.

By setting set and reset points for Relay

It indicates the level value at which relay 1 will set. User can edit the value using INC & SHIFT keys.

It indicates the level value at which relay 1 will reset. User can edit the value using INC & SHIFT keys.

It indicates the level value at which relay 2 will set. User can edit the value using INC & SHIFT keys.

It indicates the level value at which relay 2 will reset. User can edit the value using INC & SHIFT keys.

It indicates the level value at which relay 3 will set. User can edit the value using INC & SHIFT keys.

It indicates the level value at which relay 3 will reset. User can edit the value using INC & SHIFT keys.

It indicates the level value at which relay 4 will set. User can edit the value using INC & SHIFT keys.

It indicates the level value at which relay 4 will reset. User can edit the value using INC & SHIFT keys.

Press 'Enter' key to go into next menu 4



Menu 4 – Volume strap table entry.

With reference to no. of straps and strap interval, enter volume against respective strap number.

It indicates strap number 001. User can start from 00 or select strap number for which Volume is to be entered. Strap number can be selected using INC & SHIFT keys. Press ENT to save and go to next.

It indicates the level and volume for corresponding strap number i.e. Strap No: 001. User can modify value using INC & SHIFT keys. Press ENT to save and go to next.

It indicates next strap number from 002. Press ENT to go to next.

It indicates the level and volume for corresponding strap number i.e. Strap No: 001. User can modify value using INC & SHIFT keys. Press ENT to save and go to next.

The Level Strap is inferred from Menu 1E) Strap Step Intr: 00100 Thus, the strap entry and value of level for corresponding Strap will increase as programmed in the strap number and the step interval

This menu will continue till strap numbers programmed in MENU 1D:

Menu 1D) Strap Max Count: 0010.



Menu 5 : Input Calibration

To enter into this mode, default password is 077.

After entering the correct password, device will display this message or else it will display message as password wrong Press ENT key to go to next.

It indicates Zero calibration. User must feed 4 mA from a stable mA source. Press ENT key and unit displays ADC count corresponding to 4 mA. Press ENT key to save and go to next.

It indicates Span calibration. User must feed 20 mA from a stable mA source. Press ENT key and unit displays ADC count corresponding to 20 mA. Press ENT key and Run Mode Display appears.



NOTE: In user enters Wrong password in any menu, device will show message as 'Password Wrong' for 5 seconds and return to menu.



Menu 6 : Output Calibration

To enter into this mode, **password is 077**

After user enters correct password, device will display this message or else it will message of "password wrong"

It indicates **Zero calibration of re-transmission output**. Adjust the count using the INC and SHIFT keys till the multimeter connected to the output terminals shows 4 mA

It indicates **Span calibration of retransmission output**. Adjust the count using the INC and SHIFT keys till the multimeter connected to output terminals shows 20 mA



6. Volume Strap Table

To generate volume strap table for linear as well as non-linear tanks, tank height (total measurement span) is divided into number of **straps** for known **equal level** or height and volume against each strap is mentioned in the table. (Refer fig 7 & 8) Level is measured in mm, cm, meter, percentage (%) and volume is mentioned in Liter, KL, gal, Ton, percentage. This data is entered in TUIC and within each strap, volume calculation is linearly interpolated with level. Hence, **more the number of straps, more accurate is the volume indication**.

Above data in strap table is required to be entered

/programmed in TUIC. Total no. of straps and its interval is entered in Menu 1D and 1E. Volume against each strap is



Fig 7. Strapping of Linear Tank



Fig 8. Strapping of Non-linear Tank

7. RS-485 Communication Protocol

Introduction

entered in Menu 4.

The communication between Host & TUIC is done on a standard RS-485 as a physical layer. The data link layer is Modbus - RTU and the function code implemented is; Function code 03 and 04.

| Query and Response Format |
|---------------------------|
|---------------------------|

| Modbus RTU (RS-485) Communication | | | | |
|-----------------------------------|---------------------|-------------------|------------------------|--|
| Query Byte No. | Query | Response Byte No. | Response | |
| 1 | Slave Address (AA) | 1 | Slave Address (AA) | |
| 2 | Function code | 2 | Function code | |
| 3 | HO Start Address | 3 | Byte count | |
| 4 | LO Start Address | 4 | HO first register data | |
| 5 | HO No. of registers | 5 | LO first register data | |
| 6 | LO No. of registers | | | |
| 7 | HO CRC-16 (BB) | | | |
| 8 | LO CRC-16(CC) | | HO last register data | |
| | | | LO last register data | |
| | | | HO CRC-16 (FF) | |
| | | n | LO CRC-16 (GG) | |

| Data observed on MODBUS-RTU register | | | |
|--------------------------------------|---------------------|--|--|
| Address | Details | | |
| 1 | Level | | |
| 2 | Relay Status | | |
| 3 | Volume MSB | | |
| 4 | Volume LSB | | |
| 5 | NA | | |
| 6 | NA | | |
| 7 | NA | | |
| 8 | Max Level | | |
| 9 | Bottom offset | | |
| 10 | Level & Volume unit | | |
| 11 | Tank No. | | |
| 12 | Relay 1 set | | |
| 13 | Relay 1 reset | | |
| 14 | Relay 2 set | | |
| 15 | Relay 2 reset | | |
| 16 | Relay 3 set | | |
| 17 | Relay 3 reset | | |
| 18 | Relay 4 set | | |
| 19 | Relay 4 reset | | |

| Level | | | |
|----------|----|----|----------|
| R1 (MSB) | R2 | R3 | R4 (LSB) |

Level & Volume Unit Explanation

| Volume | | Level | |
|---------------|-----|--------------|-------|
| (Higher byte) | | (Lower byte) | |
| 0000000 | gal | 0000000 | % |
| 0000001 | ltr | 0000001 | mm |
| 00000010 | KL | 00000010 | cm |
| 00000011 | Ton | 00000011 | meter |
| 00000100 | % | | |

Volume – (65535*MSB

Volume = (65535*MSB) + LSB

Remarks

- 'AA' is two byte salve address, which is variable from 1 to 247 depending upon selection in display parameters
- 'BBCC' and 'FFGG' are two byte CRC on Query side Response side respectively.

8. Periodic Maintenance

• Check and tighten all electric connections.

9. Troubleshooting

| SL | Problem | Cause | Solution |
|----|---|--|--|
| 1 | No Display | Improper supply or loose connection Wrong supply polarity in case of 24VDC Fuse blown | Check supply & tighten loose connection Connect 24 VDC with correct polarity Check supply is within limit Replace fuse (F1) (500 mA for 230VAC) |
| 2 | No change in display value | No change in signal from X'mitter Wrong connection | Problem in transmitter Check and connect X'mitter with correct polarity |
| 3 | Fluctuation in display value | O/P of 'X'mitter' is fluctuating Turbulence in liquid | Check & tighten loose connections if any Install X'mitter at turbulent free location |
| 4 | Display Appears faded | Fading due to direct exposure of LCD display to sunlight | Provide proper shed ('TUIC' should be protected from direct sunlight) |
| 5 | Incorrect Relay Operation | Incorrect Relay Setting | Recheck and program TUIC with correct set & reset values |
| 6 | Re- transmission current not proper | Incorrect programming for re- transmission Improper wiring | Recheck programmed values Refer connections in 'Termination & Wiring' for correct wiring |
| 7 | RS485 communication failure | Termination wrong polarity Slave and baud rate values are not matching with Master Loose termination | Check and correct the wiring Check and reprogram with correct values Tighten the terminals |
| 8 | Volume Display Incorrect | Wrong volume strap entry | Check strap entry (Refer Menu 4 prog.) |

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