***Section One***

***Introduction***

**** Warning

READ THE MANUAL BEFORE SERVICING THIS METER

***Generalization***

The Meter is a battery-operated process maintain ace field device which combined both digital-parameter function with process-signal source together.

Functioning as follows:

* Measurement function of TC voltage, DC voltage , Ohms, DC, Continuity and Diode; Data reserving function;
* Output function of DC (Constant, Manual-Step and SIMULATE modes)
* Loop-circuit testing function; Powering the loop circuit with 24 Voltage and testing the current; Built-in 250 Ω HART loop resistance
* Safety: complied with IEC 61010-1 safety requirements for measurement, control and electronic instruments for lab use.

***Opening the Meter Case***

Check the product to see whether it is damaged in the shipment or not. Check the materials to see whether they are the same as shown in the packing list. Keep the packing materials for late delivery.

Standard and chosen accessories supplied are listed as follows. Chosen ones are bought at purchaser’s options.

Standard accessories

• 1 testing wire(with alligator clips)

• 1 user’s manual

• 2 1.5V (LR6)Alkaline batteries

• 2 100mA/250V Fast Fuses

***Safety information***

The design, manufacture and test of the Meter reach the IEC 61010-1 Safety Requirements. This Manual contains all warnings and safety regulations that must be followed to ensure safe operation and retain the meter in safe condition. Read the following instructions before operation.

Mark  in the Meter means the operator needs to make reference to related parts in the Manual to ensure safe operation.

**Warning** indentifies conditions and actions that pose hazard(s) to the user;

**Caution** indentifies conditions and actions that may damage your meter.

**Note** indentifies symbols from which you can understand operation and features of your meter. For related international symbols used by the Meter and the Manual, please read Table 1-1 for reference.

**** **Warning**

* Do not use the meter if it is damaged. Before using the meter, inspect the case. Look for cracks or missing plastic. Pay particular attention to the insulation surrounding the connectors.
* Make sure the battery door is closed and latched before operating the meter.
* Remove test leads from the meter before opening the battery door.
* Inspect the test leads for damaged insulation or exposed metal. Check test leads before using the meter. Replace the damaged leads before use.
* Do not use the meter if it operates abnormally. Protection may be impaired. When in doubt, have the meter serviced.
* Do not operate the meter around explosive gas, vapor, or dust.
* Use only type AA batteries, properly installed in the meter case to power the meter.
* Use caution when working above 30V ac rms, 42V ac pk, or60V dc. Such voltages pose a shock hazard.
* When using the probes, keep fingers behind the finger guards on the probes.
* Connecting the common test lead before connecting the live test lead. When disconnecting test leads, disconnect the live test lead first.
* Read carefully and make sure well understanding of this Manual before use.
* Make sure the requirements in the Manual are strictly followed and keep the Manual for reference whenever needs.
* Mis-operation may cause accidents and damages to the Meter in testing.

** Caution**

To avoid possible damage to the Meter or to equipment under test:

* Make sure the rotary switch is in the right position, disconnect the testing leads and the circuit under test before rotating, conversion in testing is prohibited in case of damaging the Meter.
* Cut all the power off and release electricity fully from all capacitor before testing online resistance, biode and continuity.
* Check fuse in the Meter before testing current (See Section Five Replacing Fuse). Cut off the power before connection. Remember: when testing current, connect the Meter with the Circuit in series. Do not connect testing leads to any circuit in parallel.
* Do not use the Meter if symbol displays.
* Do not store or use the Meter in high temperature, high moisture, explosive, inflammable, strong electromagnetic environment and dew or direct sunlight place.
* Do not use abrasive or solvent to clean the Meter, use a damp cloth or neutral detergent instead.
* Make dry before store if the Meter is damp.

***Symbols***

For related international symbols used in the Meter and the Manual, please read Table 1-1 for reference.

Table 1-1 International Symbols

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Meaning** | **Symbol** | **Meaning** |
|  | Alternating current |  | Earth ground |
|  | Direct current |  | Fuse |
|  | alternating or Direct current |  | Double insulated |
|  | Risk of danger. Important information. See Manual |  | Battery |
|  | Conforms to European Union directives | | |
| **CAT III** | Overvoltage of class three, secondary pollution (according to IEC61010) refers to the level of protection for the pulse compression. Typical installation location includes: distribution of three-phase circuit (including a single commercial lighting circuit) position-fixed equipment; interior lighting equipments in large buildings, lines; industrial field devices. | | |
| **CAT Ⅳ** | Overvoltage of class four, secondary pollution (according to IEC61010) refers to the level of protection for the pulse compression. typical installation location includes: Three-phase utility power supply equipment for any outdoor power lines or equipment; Any outdoor transmission lines; Electricity meter front-end over-current protection device. | | |

***Section Two***

***Understand Meter***

Study this section to understand all features and functions.

***Power-on***

Turn the rotary switch to the position to start a function.

When powered-on, the Meter starts inner self-diagnose and displays in full screen before undergoing related operations.

****Note

Power-on: wait for 5 seconds before restart to make sure correct current operation.

***Automatic Power-off***

Factory-setting defines that the Meter will automatically power off if no operation undergoes within 15 minutes.

If automatically power off, turn rotary switch to OFF position and then restart.

User can choose automatic power-off function (See Section 3 “Setup function”)

Note: we suggest turning rotary switch to OFF position if no work is undergoing because there is about 300uA loss even if the Meter is automatically powered-off.

***Low-battery display***

Replace batteries as soon as possible if symbol  displays on the screen.

**** Warning

To avoid possible electrical shock and body injury caused by wrong readings, replace batteries as soon as possible if symbol  displays on the screen.

***Rotary Switch***

Turn the rotary switch to any position to open the Meter. Standard display of the function will appear in the screen.

Press green button to select green function of the rotary switch.

When the rotary switch turned to another function, the screen will display information of the new function. Sets on a certain function will not extend to another one.

Rotary Switch is shown in Figure 2-1.Illustration for rotary position is shown in Table 2-1.



Figure 2-1 Rotary Switch

***Push Buttons***

Push buttons are shown in Figure 2-2.Illustration for press buttons are shown in Table 2-1.



Figure 2-2 Push Buttons

Table 2-1 Rotary Switch

|  |  |  |
| --- | --- | --- |
| **Position** | **Rotary switch function** | **Green Button Function** |
|  | ACV measurement | none |
|  | DCV measurement | none |
|  | Resistance measurement | none |
|  | Continuity test | Diode test |
|  | DcmA measurement | none |
|  | current output | 25%,100% step output |
|  | simulate transmitter |
|  | Loop-circuit current measurement (loop power) | none |
|  | Loop-circuit current measurement with 250Ω HART Resistance (loop power) | none |

Table 2-2. Press Button

|  |  |
| --- | --- |
| **Press button** | **illustration** |
|  | Under measurement function: readings display and held function  Under output function: select output set towards left. |
|  | Under output function: select output settings towards left. |
|  | set output :increase set value;  Step output: output makes step and linear increase by 25% or 100% for each press. |
|  | Set output: decrease set value.  Step output: output makes step and linear decrease by 25% or 100% for each press. |
|  | in position, select diode measurement;  in  and position, select 25% or 100% step output. |
|  | shift between unit mA and mA％. |

***Screen Display***

Display screen is shown in Figure 2-3.Illustration for display screen is shown in Table 2-3.



Figure 2-3 Display screen

Table 2-3. Display screen

|  |  |  |
| --- | --- | --- |
| **NO.** | **Display** | **Illustration** |
| 1 |  | Lights when measurement is active |
| 2 |  | Lights when output is active |
| 3 |  | Lights when measured value is held in measuring mode |
| 4 |  | Data display |
| 5 | SIMULATE | Lights when the Meter works in simulate transmitter mode. |
| 6 | 250Ω HART | Lights when 250Ω HART resistance function is active |
| 7 |  | Lights when calibration is active. |
| 8 |  | Shows low battery state |
| 9 | LOOP POWER | Starts 24v loop circuit power supply |
| 10 | ACDC | Direct current, Alternating current |
| 11 | **％**  **mVA**  **kΩ** | Measurement or output unit |
| 12 | **25％**  **100％** | Shows 25% or 100% manual-step output of Dc mA in output mode |
| 13 | **▲▲▲▲▲** | output set |
| 14 |  | continuity test function in measurement mode |
| 15 |  | Lights in diode test function |
| 16 |  | More than 30v input voltage in measurement mode |

***Input/output terminals***

Input/output terminals are shown in Figure 2-4.Illustration is shown in Table 2-4.



Figure 2-4 input/output terminals

Table2-4. Input/output terminals

|  |  |  |
| --- | --- | --- |
| **NO.** | **terminals** | **illustration** |
| 1 | +LOOP | output point for loop circuit power |
| 2 | mA | current measurement input  common point for DC output  common point for loop circuit power  Simulates the output of a transmitter group (with external power supply connected in series.)  With protection by 100mA fuse. |
| 3 | COM | common point for all testing  Common point for simulate transmitter output. |
| 4 | VΩ | voltage output of 600V、Ω、diode and continuity test. |

***Using display hold mode（Display HOLD）***

Under output mode, the Meter freezes data displayed in the reading part when pressing button to enter into display hold mode (screen displays symbol). Repress  button to exit from display hold mode.

***Section Three***

***Operation***

This section introduces how to use this Meter.

Most functions are available by turning rotary switch.

White symbols besides rotary switch indicates main function, green symbols indicates replacing function. Press green button to use the replacing function.

***Measuring AC voltage***

1. turn the rotary switch to “”;
2. insert black probe into “COM” terminal ,and insert red probe into “ΩV” terminal;
3. Connect the probes to the circuit under test and then read the measured value when stable.

***Measuring DC voltage***

1. Turn the rotary switch to “”;
2. Insert black probe into “COM” terminal ,and insert red probe into “ΩV” terminal;
3. Connect the probes to the circuit under test and then read the measured value when stable.

**** Warning

* Do not input voltage higher than DC 600V or AC 600V rms. There is a risk of damaging the Meter though it is possible to display a higher voltage.
* When the input voltage is higher than 30v, symbol displays for warning.

***Measuring resistance***

**** Warning

* To avoid damage to the Meter or equipment under test, cut all power off and release electricity fully from all capacitor before testing continuity.

1. turn the rotary switch to “Ω”;
2. insert black probe into “COM” terminal ,and insert red probe into “ΩV” terminal;
3. Connect the probes to the circuit under test and then read the measured value when stable.

**** Note

* The screen displays  if the open circuit or resistance of the device under measurement exceeds the maximum range of the Meter.
* Because the testing current output by the meter may go through all possible links between probes, the measured resistance value in the circuit could be different from the rated value

***Continuity test***

**** Warning

* To avoid damage to the Meter or equipment under test, cut all power off and release electricity fully from all capacitor before testing continuity.

1. turn the rotary switch to“”;
2. insert black probe into “COM” terminal ,and insert red probe into “ΩV” terminal;
3. Connect the probes to the circuit under test and the buzzer beeps when the circuit connected (resistance lower than 20Ω)

***Diode Test***

**** Warning

* To avoid damage to the Meter or equipment under test, cut all power off and release electricity fully from all capacitor before testing continuity.

1. turn the rotary switch to“”, press green button and select test;
2. insert black probe into “COM” terminal ,and insert red probe into “ΩV” terminal;
3. Connect the probes to the diode under test and then read the measured value when stable.

Forward test: connect the red probe to the positive polar of the diode under test and black probe to the negative polar, the screen displays approximate value of diode forward voltage drop, about 0.5～0.8V generally.

Adverse test: connect the red probe to the positive polar of the diode under test and black probe to the negative polar, the screen displays  in normal case.

***Measuring Current***

**** Warning

To avoid damage to the Meter or equipment under test, make sure both the rotary switch position and input terminal position conforms to the required measurement mode.

1. turn the rotary switch to“”
2. insert black probe into “COM” terminal ,and insert red probe into “mA” terminal;
3. Connect the probes to the circuit under test and then read the measured value when stable.
4. Press  button to display current value in percentage form.

Table 3-1 current value in percentage form.

|  |  |
| --- | --- |
| current value | Displayed In percentage form |
| -22.000mA | -162.50% |
| 0.000mA | -25.00% |
| 4.000mA | 0.00% |
| 20.000mA | 100.00% |
| 22.000mA | 112.50% |

***Measuring loop-circuit current***

The function may measure current value powered with 24VDC constant voltage.

24V loop-circuit measurement function may test transmitter loop circuit.

The meter may be connected to transmitter, but not to transmitter or signal adaptor.

**** Warning

Typical value of loop power supply is 24DVC. Voltage between terminals could be higher than 24V in different situations, such as current value in loop circuit or internal connection in series.



Figure 3-1 Measuring Loop Circuit Current

1. turn the rotary switch to“””, and the screen displays “ LOOP POWER”;
2. insert black probe into “mA”” terminal ,and insert red probe into “+LOOP” terminal;
3. Connect the probes to the circuit under test and then read the measured value when stable.
4. Press  button to display current value in percentage form.

***Measuring loop-circuit current with 250Ω HART resistance***

1. turn the rotary switch to“”, and the screen displays “ LOOP POWER” and “250Ω HART”;
2. insert black probe into “mA”” terminal ,and insert red probe into “+LOOP” terminal;
3. Connect the probes to the circuit under test and then read the measured value when stable.
4. Press  button to display current value in percentage form.

***Using current output function***

The meter offers 0-20 mA and 4-20mA current output functions.

Two output modes:

SOURCE mode: supply current from internal source;

SIMULATE mode (simulate): absorb current from external source

Two Configuration modes:

Constant current output: constant output of designated current.

Manual-step output: output current increases or decreases in 25% or 100% step.

If you need to apply current for non-source circuit (such as loop current without power), then select SOURCE mode. The meter consumes more battery power of being used as current source than that of being used in SIMULATE mode, so select SIMULATE mode if possible.

**** Warning

Do not apply output terminals with voltage higher than 30v; otherwise it may lead to electric shocks.

Make sure that the voltage between circuit and ground wire is lower than 30v. Be sure to use the enclosed probes and wires (check them to see whether they in a suitable measurement mode).

**** Warning

Do not apply any voltage to output terminals except in SIMULATE mode. Any wrong application may damage internal circuit.

***Constant current output (SOURCE mode)***

1. Turn the rotary switch to“”;the screen displays “OUTPUT” and “LOOP POWER”; output is set as 0mA.
2. insert black probe into “mA”” terminal ,and insert red probe into “+LOOP” terminal;
3. Press  button to display current value in percentage form.
4. press、、、buttons to set output value.
5. Connect the leading wire to the circuit under test.

***Constant current output (SIMULATE mode)***

SIMULATE mode refers to simulate a group of loop-circuit current transmitter with the Meter.

If there are cases of an external DC voltage (range from 5-28 v) and tested loop current in series, then select SIMULATE mode.

**** Warning

Before connecting the testing lead to loop circuit current, turn the rotary switch to any position of mA output. Otherwise, low impedance from other position of rotary switch will appear and cause current higher than 35mA to go through the loop circuit.

Set the polar of applied voltage as shown in Figure3-2, do not connect reversely.



Figure 3-2 current output in SIMULATE mode

1. Turn the rotary switch to“”; the screen displays “OUTPUT” and “SIMULATE”; output is set as 0mA.
2. insert black probe into “mA”” terminal ,and insert red probe into “mA” terminal;

Press  button to display current value in percentage form.

1. press、、、 buttons to set output value.
2. Connect the leading wire to the circuit under test.

***Manual-step output***

In constant current output mode, press green button to select manual-step output function: increases or decreases in 25% or 100% step.

Press 、button may increase or decrease current in 25％or100％ step. See Table3-1

***Setup function***

Setup function may:

1. Start and close automatic power-off function;
2. Open and close buzzer.

In power-off state, press button and turn the rotary switch from OFF to any other position simultaneously. Wait for 2 seconds and then loosen.

Press button to select setup function; press  button to change setup state; press green button to hold setup value.

***Section Four***

***Maintenance***

This section provides some basic maintenance procedures. Repair, calibration, and servicing not covered in this manual must be performed by qualified personnel. For maintenance procedures not described in this manual, contact a Victor’s Service Center.

***General Maintenance***

Periodically wipe the case with a damp cloth and detergent; do not use abrasives or solvents.

* Take out the batteries if the meter won’t be used for a long time.
* Dirt or moisture in the terminals can affect readings.

Clean the terminals as follows:

（1）、Turn the Meter off and remove all test leads.

（2）、Shake out any dirt that may be in terminals.

（3）、Soak a new swab with alcohol. Clean each terminal with the swab.

***Replacing the batteries***

The Meter is powered by two AA batteries (IEC LR6).

**** Warning

To avoid electrical shock or personal injury:

* Remove test leads from the meter before opening the battery door.
* Close and latch the battery door before using the meter.

**** Note

* The new and old Batteries can not be mixed.
* Make sure the battery’s odes are in accordance with the symbols illustrated in battery pool when replacing them.
* Take out the batteries if the meter won’t be used for a long time.
* Dispose the old batteries in accordance with the local law.

Replace the batteries as follows.( Refer to Figure 4-1).



Figure 4-1 replacing the batteries

1. turn the rotary switch to OFF and remove the test leads from the terminals;
2. take off the protector of the meter , remove the battery door by using a standard-blade screwdriver to turn the battery door fasteners, and then take of the battery case;
3. replace with two new batteries;
4. Reinstall the battery case and tighten screws.

***Replacing fuses***

****Warning

To avoid personnel injury or damage to the meter, use only the specified fuse. The specification is 100mA 250V fast-melt.

3mA 250V-fuse protection is in the mA current output terminal. To check whether fuses are blown:

1. Turn the rotary switch to 
2. Plug the black test into COM, and the red test lead into the mA input.

Use an ohmmeter to check the resistance between test leads .If the resistance is about 20Ω, the fuse is good. An open reading means that fuse is blown.

Replace the fuse as follows. (Refer to Figure 4-2 if necessary).

1. Remove the test leads from the meter and turn the meter OFF.
2. Take off the protector of the meter, remove the four screws by using a standard-blade screwdriver, and then take off the cover.
3. Replace the blown fuse(s).
4. Reinstall the cover.
5. Reinstall the protector.



Figure 4-2 replacing a fuse

***Section Five***

***Specification***

***Safety and conformity***

|  |  |
| --- | --- |
| overload protection | V~COM terminal：AC600V/10 seconds。  mA terminal：100mA/250V fast-melt fuse |
| legal conformity | IEC61010-1（CAT Ⅳ 600V、CAT Ⅲ 1000V、Pollution ClassificationⅡ） |
| electromagnetic compatibility | Conforms to IEC61326-1，Group 1、Class B |
| Surge protection | 8kV（according to IEC61010.1-2001） |
| Identification Mark | CE |
| Quality Standard | Develops , designs and manufactures in confirmty with ISO 9001 |

***General feature***

|  |  |
| --- | --- |
| Display Screen | digit: display in four digits(5 in current measurement and output) |
| refresh display | 2.5 displays/second |
| operation temperature and moisture range | 0～40 ºC, relative moisture≤85%(no condensation) |
| storage temperature and moisture range | -20 ºC～60 ºC、relative moisture≤90%( no condensation) |
| accuracy required temperature and moisture range | 23±5ºC、relative moisture≤75%( no condensation) |
| temperature co-efficiency | 0.1 × basic accuracy / ℃（temperature range <18℃ or >28℃） |
| ambient condition for operation | Indoor, outdoor operation（no waterproof），at an altitude of 0～2,000 meter |
| indicator for over-range | OL |
| continuity/open test | Beeper sounds for resistance readings below threshold, or to indicate a momentary open circuit |
| battery type | two AA 1.5V Alkaline (LR6) batteries |
| battery life | when using alkaline battery:  measures any parameter: about 100 hours;  DC current output(SIMULATE)：about 50 hours;  DC current output (SOURCE)20mA(1000Ω load)：about 2.5 hours. |
| low battery | displays battery symbol |
| automatic power-off | The default value is 5 mins if no operation which is adjustable. |
| preheating time | 10min |
| closed – case calibration | No internal adjustments needed |
| battery access door | Battery or fuse replaceable without voiding calibration |
| Measurement | 180（L）×90（W）×47（D）mm |
| weight | about 500g |
| calibration period | one year |

***Detailed accuracy indicator***

Accuracy is specified for a period of one year after calibration, at 23±5ºC, with relative humidity to 75 %.

Accuracy specifications are given as:± ( [ % of reading ] + [ number of least significant digits ] ) (note: “number of least significant digits” means the digits increased or decreased in least significant digits)

***Measuring detailed accuracy indicator***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measuring part** | **range** | **frequency** | **accuracy** | **remark** |
| DC voltage | 50V | 10mV | 0.5%+4 | • Measuring impedance 10 MΩ (standard value)  • Common mode restrain: 50Hz or 60Hz > 100Db  • String mode restrain:50Hz or 60Hz > 45dB  • Overload protection: 600V (peak –peak value) |
| AC voltage | 500V | 100mV | 0.5%+20 ( 45Hz~100Hz ) | • frequency beeps: 45Hz～400Hz  • Adaptive to range from 10% to 100%  • AC conversion: mean value  • Measuring impedence:10 MΩ(standard value)<100pF  • Common mode restrain: 50Hz or 60Hz > 100Db  • Overload protection: 600V(peak –peak value) |
| 2%+20 ( 100Hz~400Hz ) |
| Ohm | 5kΩ | 0.001kΩ | 0.5%+4 | • open-circuit voltage: <5V;  • short-circuit current: about 0.1mA.  • leads resistance excluded in the accuracy;  • overload protection: 600V |
| continuity | 500Ω | 0.1Ω | Short-circuit beep is about 20Ω | • open-circuit voltage: <5V  • short-circuit current: about 0.1mA.  • overload protection: 600V(peak –peak value) |
| diode | 2V | 0.001V | 1%+20 |
| DC current | 20mA | 0.001mA | 0.2%+4 | • overload protection: 100mA/250V fast-melt protection;  • loaded voltage: about 18mV/mA |

***Outputting detailed accuracy indicator***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **output function** | **range** | **output designated range** | **frequency** | **accuracy** | **remark** |
| DCI  DC current | 20mA | 0.000～22.000mA | 0.001mA | 0.2%+4 | • Max. load: 1kΩ at 20mA |
| SIMULATE  Simulate transmitter | **-**20mA | 0.000～**-**22.000mA | 0.001mA | • external power supply: 5～28V  • Max. load: 1kΩ at 20mA |
| LOOP  Loop-circuit power | 24V |  |  | ±10% | • Max. output current 25mA |
| * Max. Voltage applied to output terminals: about 32V; Max. current applied to output terminals: about 25mA; * Protection in output terminal :100mA/250V Fast fuse | | | | | |

**Notice of the Manual**

* The present operation instruction is subject to change without notice.
* The content of the operation instruction is regarded as correct. Whenever any user finds its mistakes, omission, etc., he or she is requested to contact the manufacturer.
* The present manufacturer is not liable for any accident and hazard arising from the customer misuse or inadvertent operation.
* The functions described in this operation instruction should not be used as grounds to apply this product to a particular purpose.