







AC VOLTAGE CONTROLLER

1. General Description

ICD Voltage controller (VC 9090) is a protection device for power system equipments, feeders and machines against Voltage disturbances of 3 phase system and is designed with latest state of art technolgy. It offers high accuracy, reliability and also real value for money. The micro controller based instrument monitors phase (R, Y & B) and line voltages (RY, YB & BR) and the faults are controlled through relay. This instrument is most suitable for measuring all electrical parameters in 3 phase industrial applications.

Phase reversal & failure are detected based on the samples taken. Unbalance Voltage between lines, under voltage & over Voltage of each line are compared with setpoint, settable in program mode. During Fault Condition the relay will be de-energised after a definite time delay which is also settable. Normal operation can be restored by manual reset or automatically when the fault is cleared.RS 485 communication output provided in rear side of the meter.

The measured phase & line voltages, fault status are shown on 6 digit 0.39" red LED seven segment display. 5 Nos of 3mm red LEDs are provided to identify the status of faults occured. Four keys are provided on the front panel of the meter to view run mode parameters as well as set parameters in program mode.

The Voltage controller is housed in a compact ABS plastic enclosure of dimension $96(H) \times 96(W) \times 120(D)mm$.

2. Installation

<u>Mounting</u>

The Voltage Controller is housed in a compact ABS plastic enclosure of dimension 96(H)x96(W)x120(D)mm. The meter is suitable for panel mounting and has reliable mounting clamps to hold the meter to the panel.

The panel cut out for fixing the meter is 92 x 92 mm. The depth behind the panel is 120 mm. Extra space should be provided for the connectors and wiring. The panel cut out should be punched with proper tool and should be free from burrs. Place the meter through panel cutout from front and fix the mounting clamps provided with the meter on each side. Tighten the fixing clamps with limit amount of force so as to hold the meter in position.

<u>Wiring</u> <u>Voltage signal connections</u>

The VM9090 directly accepts voltages upto 415VAC R.M.S line to line (240VAC R.M.S line to neutral) with 10% over load capacity in case of LT meters . The primary of the PT is field programmable through keypad

There are four voltage input terminals marked as R, Y, B & N. The three phase input voltage should be connected to those terminals.



Normal & Run Mode Parameters are displayed in the 6 digit 0.39" 7 segment LED Display. 5 Nos of 3mm red LED indications are provided to identify the status of faults, assigned as - UV(under voltage), OV(over voltage).

1x4 matrix key keypad is used to view all the parameters in Normal Mode & in program mode. The key descriptions are given below. The keys are used to select the respective parameters in the normal operating mode and to configure various items in the program mode.

<u>Keys</u>	Program mode	Normal operating mode
# scrl/hld	Index key	Scroll/hold select
	Shift Key	Display Page Increment
$\overrightarrow{}$	Increment Key	Display page decrement
	Enter Key	Relay Acknowledge



5. Programming Instructions

All meters are to be programmed properly to work in a particular Installation. The various items that are to be programmed are shown in the table below.



Enter valid Password as in New password menu

The units are provided with password facility to prevent alteration of configuration items by unauthorised persons. With power applied to the meter hold in the shift and lncr keys together for 3 seconds. The display Indicates enter password.



Program mode

The valid password as set in the configuration item, new password has to be entered by using Shift, Incr and enter keys (Refer changing the configuration items for using Shift, Incr and Enter keys). After valid password is entered the meter enters into program mode by showing it in display.

Special Note : If the user enters the 'Enter pass word' for the first time, or if the user fails to remember the password entered in 'New pass word', the default pass word 0386 can be entered.



Changing the configuration Items

After selecting the configuration item through Index key, It can be altered by using shift, Increment & Enter key. (Program mode)

The shift () key is used to select the digit one by one. The selected digit is shown by flashing that digit.

The Increment (\blacktriangle) key is used to increment the selected digit. The increment key Increments the digit from 0 to 9 and then wraps down to zero once again.

Once the required values are set in the configuration items press the Enter \dashv key to store it in memory. If the change is accepted the display Indicates 'E' otherwise an error message is displayed as 'Error'.

Once the configuration Items are programmed hold in the

& **A** keys together for 3 seconds to return back to normal operating mode.



When power is applied to the instrument, it displays 'ICd-07' for few seconds and scrolls to indicate the R phase Voltage. The normal operating mode is selected automatically. In normal operating mode the voltage parameters are shown in different pages. These pages are accessed using the Shift () & Increment () keys provided on the front panel. The display pages, can also be made to scroll automatically 5 seconds once by selecting scroll mode. The scroll/ hold mode is selected through scrl/hld key. The selected mode is shown initially (Either 'ScroL' or 'Hold'). The available display pages are given



7. Functional Description

When instrument is switched ON, it shows ICD-07 for a while and displays the phase voltage(R). Pressing increment key displays phase voltage (R,Y& B), line voltage RY, YB, BR, Fault Message & Fault register Values. (Initially when the unit is powered it selects run mode.)

The display pages, can also be made to scroll automatically 5 seconds once by selecting scroll mode through 'Scrl/Hld' key. Message 'SCrLL' will be displayed initially when scroll/Auto mode is selected.

The instrument controls the Under & Over Voltage, Drop Out & Pickup Voltage & unbalance voltages according to control settings programmed in program mode.

7.1 Control Action :

Voltage Monitor is provided with Relay Output for control purpose during fault conditions. Relay is de- energized for normal operation and energised during fault condition.

Relay get de- energised (auto reset) on reaching the set value for Fault1, whereas for fault2, relay is energised, by pressing the 'Ack' key manually (though fault is cleared or not).

7.2 Fault :

Fault status is identified by relay action, also by respective LED indication & Fault message with definite time delay. When more than one fault occurs at same time, the fault first recognised will be displayed. but LEDs corresponding to all all faults will glow. Faults are classified in to

Fault1 : (Under Voltage, Over Voltage and unbalance)Fault2 : (Phase Failure & Reverse Sequence)

When more thant one fault occur at a time, Phase fail is given higher priority followed by reverse sequence. The reading at which fault oc-

cur is registered in Fault Registry 'Fr' and is displayed Fault messages h) r -- uV : R Phase under voltage a) r - PHFL : R Phase Failure b) y - PHFL : Y Phase Failure i) y -- uV : Y Phase under voltage j) b -- uV : B Phase under voltage c) b - PHFL : B Phase Failure d) ry - unb : RY ph unbalance with YB k) r -- oV : R Phase over voltage e) yb - unb : YB ph unbalance with BR l) y -- oV : Y Phase over voltage f) br - unb : BR ph unbalance with RY | m) b -- oV : B Phase over voltage : Reverse Sequence (RBY, YRB, BYR) g) seqrby **Note:** Fault1, Drop out & pickup voltage are compared with line voltages RY, YB

and BR wherease fault2 is based on Individual Phase.

7.2.1 Under Voltage :

1) Fault is recognised, When the

Line voltage \leq (under voltage set - dropout voltage set)

2) Fault is cleared automatically, when the

Line voltage \geq (undervoltage set + pickup voltage set)

7.2.2 Over Voltage :

 Fault is recognised, When the Line voltage ≥ (over voltage set + dropout voltage set)
 Fault is cleared automatically, when the

Line voltage \leq (over voltage set - pickup voltage set)

7.2.3 Unbalance voltage:

1) Unbalance is recognised, When the

difference of Line Voltage (between each Line) is not between \pm % of 'unb' set value, when compared in sequence RY, YB & BR

Eg. Unb set = 20% RY=334.1, YB=334.3, BR=410.2

comparision is made, by comparing $\pm 20\%$ of line voltage of RY with YB, YB with BR & BR with RY and so on. In this example, YB voltage falls within $\pm 20\%$ of RY Voltage, whereas BR voltage doesn't fall within $\pm 20\%$ of YB Voltage. Hence Fault

message is 'yb-unb' (comparision reference phase is displayed in fault message).

2) fault is recovered automatically, when the Line voltage is maintained within the Unbalance Limit.

7.2.4 Phase Failure :

1) Phase failure occurs during absence of one or two phase or when voltage reduces less than working range in any phase.

2) Fault is recovered by adjusting the working voltage between (50 to 110%) or clearing phase absence and acknowledging the relay.

7.2.5 Reverse Sequence :

Reverse sequence occurs when PT wiring is given as RBY (or) YRB (or) BYR. Correct sequences are RYB (or) YBR (or) BRY
 Fault is recovered by, wiring in a correct sequence as mentioned

 Fault is recovered by, wiring in a correct sequence as mentioned above and acknowledging the relay.

7.3 Time Delay :

1. During Fault condition, the relay de-energises, the respective LED gets ON & fault message is updated after a definite time delay which is programmable under menu '1td 002' & '2td 02' for fault1 & 2 respectively. Time delay is applicable during fault set and reset.

2. For fault2, if fault is acknowledged, LED indication & fault message get resets (after a time delay), only if fault is cleared whereas relay energises as soon as it is acknowledged. For Phase Failure, recovery time delay is calculated from the time of clearing the fault. *Note : Time delay is not applicable for reset of fault, Reverse sequence*

Relay Action:

The output relay should be energized for under voltage & over voltage condition.

8. Calibration Procedure

To select the calibration mode press shift & increment key together for a period of 5 sec . The display shows Calibration password as



9. Commissioning Of Voltage Controller

Before fixing the unit into the panel

★ Thoroughly read the operating manual, if queries arised contact ICD's sales representative.

★ Visualize the unit for any physical damage, which may caused during the transportation.

★ If severely damaged, unpack the instrument and contact ICD's factory or its representative.

★ After physical inspection, complete the external wiring and switch ON the unit for preliminary check (if necessary).

★ The display page shows the 'R' Phase Voltage.

★ Program the required Setting parameters.

★ After the complete satisfaction, fix the instrument into the panel and complete the external wiring.

Excess voltage can damage the instrument, <u>lesser voltage</u> can cause improper functioning.

10. Technical specification

Type Model Voltage Input Frequency Range Display Resolution Indicating Accuracy Displayed Parameters Faulty condition display PT Primary setting	 ICD Voltage controller VC 9090 440 VAC 45 to 55 Hz. 6 digit 0.39" 7 segment red LED 0.1V Class 0.5 R, Y, B, RY, YB, BR Voltages The last reading at which fault occured is stored and displayed Programmable thru' keypad
Control Action .	
Output Contact Rating Relay reset on fault1 reset on fault2	 1 C/O potential free relay contact. 3Amps at 230V AC Relay reclosed on reaching the Voltage set value Manual Reset by pressing 'Ack' key
<u>Others</u> :	
Under Voltage setting	: 210.0 to 411.0 V
Over Voltage setting	: 420.0 to 457.0 V
Unbalance setting Time delay set (fault1)	 1 to 30V 1 - 150 secs in steps of 1 seconds for unbalance, Over voltage & Under Voltage
Time delay set (fault2)	: 1 - 60 secs in steps of 1 seconds for Phase Failure & Phase reversal.
Fault1 Category	: Under Voltage, Over Voltage & Unbalance.
Fault2 Category	: Phase Failure & Phase reversal.

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Pickup Voltage	: 0.00 to 20.0 V AC			
Drop Out Voltage	: 00.0 to 10.0 V AC			
Status Indication	: Available for UV, OV, UNB, Phase Failure & Phase Reversal			
Fault Indication	· By 5 Nos of red LEDs & Display Message			
	& control action.			
Parameters Setting	: Programmable through 1x4 Matrix keypad			
Auxiliary Supply	: Self powered			
Communication	: RS 485 Communication output			
Box Dimension	: 96(H) x 96(W) x 120(D) mm			
Mounting	: Panel.			
Enclosure	: ABS Plastic Enclosure.			
(** - To be specified while ordering)				

11. Communication Port Details

The **Voltage controller** is provided with a optically Isolated **RS 485** communication Port. It is an optional Feature and has to be specified at the time of ordering. The communication protocol used is **MOD BUS - RTU** Type. Using the communication Port, the meters can be connected in multi drop network and datas can be collected in a centralised control room using any standard **SCADA** Software.

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The communication settings are,

Protocol	:	MOD BUS RTU
Baudrate	:	9600
Data bit	:	un signed
Stop bit	:	1
Parity	:	None
Communicating	:	RTU/MODBUS
mode		
NO OF Elements	:	01

The address of the parameters are,

		Address	Resolution
R - Phase voltage	:	40001	0.1
Y - Phase voltage	:	40002	0.1
B - Phase voltage	:	40003	0.1
RY- Line voltage	:	40004	0.1
YB - Line voltage	:	40005	0.1
BR - Line voltage	:	40006	0.1
Fault Status	:	40007	
Fault Value	:	40008	

Fault Status Details :

Sequence Reverse	:	1
R-Phase fail	:	2
Y-Phase fail	:	3
B-Phase fail	:	4
R-Phase Under Voltage	:	5
Y-Phase Under Voltage	:	6
B-Phase Under Voltage	:	7
R-Phase Over Voltage	:	8
Y-Phase Over Voltage	:	9
B-Phase Over Voltage	:	10
R-Phase Unbalanced	:	11
Y-Phase Unbalanced	:	12
B-Phase Unbalanced	:	13