9848
AC Voltage & Current
Power Calibrator

User's Manual

Contents

1. Checking Results

Table 1.1. The checking results of the calibrator

Function	Settings U [V]	I [A]	f Hz	φ [°]	Limits of intrinsic error	Measurement results: Intrinsic error in phase L1	L2	L3	Uncertainty of measurement
„U" Voltage	0,50		48		±0,030V	+0,004	+0,001	+0,004	±0,001V
	30,00				±0,045V	+0,006	+0,013	+0,014	±0,003V
	60,00				±0,060V	+0,005	+0,016	+0,012	±0,006V
	1,00				±0,030V	+0,004	+0,000	+0,003	±0,001V
	65,00				±0,062V	+0,005	+0,008	+0,016	±0,007V
	130,00				±0,095V	+0,016	+0,030	+0,028	±0,013V
	2,0				±0,30V	−0,02	+0,01	+0,05	±0,01V
	125,0				±0,36V	+0,06	+0,02	+0,00	±0,02V
	250,0				±0,42V	+0,04	+0,02	+0,06	±0,03V
	3,0				±0,30V	−0,02	−0,01	+0,05	±0,01V
	210,0				±0,40V	+0,02	+0,08	+0,15	±0,03V
	420,0				±0,50V	+0,02	−0,05	+0,10	±0,05V
„I" Current		0,0100			±0,00030A	+0,00004	+0,00007	+0,00006	±0,00001A
		0,6500			±0,00062A	+0,00006	+0,00016	+0,00010	±0,00007A
		1,3000			±0,00095A	+0,00015	+0,00025	+0,00010	±0,00013A
		0,050			±0,0030A	+0,0003	+0,0010	+0,0009	±0,0001A
		3,000			±0,0045A	+0,0000	+0,0013	+0,0007	±0,0003A
		6,000			±0,0060A	−0,0010	+0,0008	−0,0018	±0,0006A
		0,200			±0,0031A	+0,0003	+0,0018	+0,0000	±0,0003A
		10,000			±0,0080A	+0,0012	+0,0016	−0,0012	±0,0010A
		19,000			±0,0125A	+0,0015	−0,0014	−0,0030	±0,0060A
		1,00			±0,031A	+0,010	+0,017	+0,018	±0,003A
		50,00			±0,080A	+0,015	+0,024	+0,004	±0,015A
		100,00			±0,130A	+0,012	+0,022	−0,014	±0,030A
„f" Frequency			45,00		±0,02Hz	−0,01			±0,005Hz
			50,00		±0,02Hz	+0,00			±0,005Hz
			70,00		±0,02Hz	+0,01			±0,005Hz
„φ" Phase	220	2	48	-90,0	±0,5°	+0,1	−0,2	−0,1	±0,02°
				-0,0	±0,5°	−0,1	−0,1	+0,0	±0,02°
				+0,0	±0,5°	−0,1	+0,0	+0,0	±0,02°
				+90,0	±0,5°	−0,1	−0,1	+0,0	±0,02°
Angle U_{L2-1}				120,0	±1,0°	+0,29			±0,1°
Angle U_{L3-1}				240,0	±1,0°	−0,35			±0,1°
Ambient temperature [°C]						+23°C			
Reference Standard						Portable Calibration Meter Calport 400 Serial No 67635			

2. Field of Application

The 9848 is a three-phase symmetrical and asymmetrical source of alternating current and voltage. Enables generating alternating voltages "U" up to 500V in four subranges 57-110-220-500V, alternating currents "I" up to 100,00A in four subranges 1-5-20-100A, frequency "f" in range 45-70Hz and phase angle "j" in range -90...0...+90°.

The 9848 calibrator is used for adjusting, checking and verification of measuring instruments used in power engineering. These include active and reactive power meters, phase meters, frequency meters, ammeters, voltmeters, transducers, monitoring systems, and frequency, voltage and current relays in single and three phase symmetrical and asymmetrical configurations for symmetrical and asymmetrical loads.

Voltage and current output signals are set by multi-turn potentiometers and are simultaneously indicated on 4.5 digit LED displays. Frequency and phase angles are also set by multi-turn potentiometers and are displayed on 4 digit LED displays. The shift angle between voltage signals are also set by multi-turn potentiometers and are shown on the 4 digit LED displays too.

Instruments to be calibrated can safely be connected to the outputs without changing the set values since the calibrator can be switched to “standby” mode to isolate the output terminals.

Sinusoidal signals are generated on both voltage and current outputs. If required, between 1% and 15% harmonic distortion can be added to the signals. Distortion spectrum complains rectangular wave with triple frequency added to main signal.

The 9848 is constructed in three standard 19” rack-mount size aluminium case. It consists of one calibrator basic configuration (Phase L1) and two calibrators in special configuration (Phase L2 and Phase L3). Calibrator Phase L1 controls Phase L2 and L3 by means of analogue and digital signals. All connections are on the rear panels. Calibrator Phase L1 is able to generate a single phase vector.

3. Technical Data

Table 3.1. Metrological parameters

Parameter	Range	Settings span	Resolution	Accuracy	Maximum Load
Voltage "U"	57V	0,50...60,00V	0,01V	±0,05% of set value ±3 digits	250mA@60V
	110V	1,00...130,00V	0,01V		140mA@130V
	220V	2,0...250,0V	0,1V		70mA@250V
	380V	3,0...500,0V	0,1V		40mA@420V
Current "I"	1A	0,0100...1,3000A	0,0001A	±0,05% of set value ±3 digits	12V@1,3A
	5A	0,050...6,000A	0,001A		3V@6A
	20A	0,200...19,999A	0,001A		2V@20A
	100A	1,00...100,00A	0,01A	±0,1% of set value ±3 digits	0,7V@50A 0,3V@100A
Frequency "f"		45,00...70,00Hz	0,01Hz	±0,02Hz	
Phase angle "φ_{L1}"		0,0...±90,0°	0,1°	±0,5° *)	
Phase angle "φ_{L2}" and "φ_{L3}"		0,0...±10,0° in relation to phase angle "φ_{L1}"	0,1°	±0,5° *)	
Total Harmonic Distortion THD (adjustable 1-15%)				0,5% of set value	
Shift angle between voltages U_{L2} and U_{L1}		110,0...130,0°	0,1°	±0,5° *)	
Shift angle between voltages U_{L3} and U_{L1}		230,0...250,0°	0,1°	±0,5° *)	
*) for settings greater than 10% on voltage and current range					

Table 3.2. Reference conditions and rated operating conditions

Parameter	Reference conditions	Rated operating conditions
Ambient temperature	+18...+23...+28°C	+5...+40°C
Atmospheric pressure	70...106kPa	
Relative humidity	20...80% non-condensing	
Power supply voltage	230V ±10%	
Power supply frequency	45...65Hz	
Power supply waveform	Sine, distortion factor $\beta \leq 0,05$	
Warm up time	30 min	

Table 3.3. General Requirements

Parameter	Requirement
Safety	Class 1 according to EN61010
Electric insulating strength (50Hz):	
power supply pins – case	1,5kV
voltage and current output terminals – case	2kV
voltage output terminals – current output terminals	2kV
control D-sub connection – case	500V
Degrees of protection electrical equipment	IP20 according to IEC529
Climatic conditions	Group I according to IEC359
Power consumption of one case	200VA
Dimensions of one case (with/height/depth)	478/194/342mm
Weight of one case	14kg

4. Precautions

The 9848 should be used in an environment providing using conditions according to Table 3.2, which are normally found in laboratories and factories and where apparatus will be handled carefully. The calibrator should not be used near salt, water and aggressive gases or near strong magnetic and electric fields. Neglected operating mechanical factors during operation are allowable according to IEC359 for instruments group I and optional operation position. The Calibrator can be used in temperatures +5° to +40°C, stored and transported at temperatures -25° to +70°C.

The 9848 is Class 1 protection instrument according to EN61010. The metal case is connected to zero lead of power cable. The Calibrator may be used in safe and dangerous localisation, i.e. in places whose operator can touch details conducting electrical current connected to ground potential.

Calibrator generate on the voltage terminals high and danger voltages. Connection and disconnection of the load should be made when "standby" function has been set ("std" lamp is on). After switching of the load, the Calibrator can be start-up by repeat pressing of the key "std" (in operate status "std" lamp is switched off). Switching of the load without using of "standby" status is dangerous:

- for high voltage ranges – electric shock danger,
- for current ranges – disadvantageous for transient.

Do not open the case and adjust or exchange details during exploitation. When the Calibrator is damaged, it should be disconnected from power supply and measurement circuit. Manufacturer provides warranty service and after warranty service.

When the fuse beside of power supply socket is overheated, then it should be exchanged on the fuse type T 1,6A.

Attention: If the casing has been tampered with then the warranty will be null and void.

5. Start-Up of the Calibrator

Front plate view of calibrator Phase L1 is shown on Fig.5.1, where are marked:

"power"	supply switch (230V nominal voltage / 45...65Hz),
"output voltage"	Output voltage terminal: high potential "HI" and low potential "LO". There are the push button and the signal lamp of standby/operate function next to the terminal. Pressing the push button causes change of lamp state. State switched on (flashing) lamps determines "standing" state, in which output voltage is disconnected from output terminals of the calibrator. State switched off the lamps determines state "operate", in which setting values of voltage signal appearing on output terminals of calibrator. The lamp "ovl" signals overrange values of distortion coefficient or amplitude error of output voltage implicated by overload of calibrator output.
"output current"	Output current terminal: high potential "HI" and low potential "LO". **The output current is electrically separated from other circuits of calibrator**. There are the push button and the signal lamp of standby/operate function next to the terminal. Pressing the pushbutton causes change of lamp state. State switched on (flashing) lamps determines "standing" state, in which output current is disconnected from output terminals of calibrator. State switched off the lamps determines state "operate", in which setting values of current signal appearing on output terminals of calibrator. The lamp "ovl" signals overrange values of distortion coefficient or amplitude error of output current implicated by overload of calibrator output,
"frequency"	The frequency of current and voltage signals is set up by the round knob. There are the pushbutton and the signal lamp of "synch" function below the display. Pressing the pushbutton causes change of lamp state. State switched on (light lamps) determines "synch" state, in which output voltage and current frequency is synchronized with frequency of power supply. State switched off the lamps determines state of setting by the knob. In both state the value of frequency is shown on display.

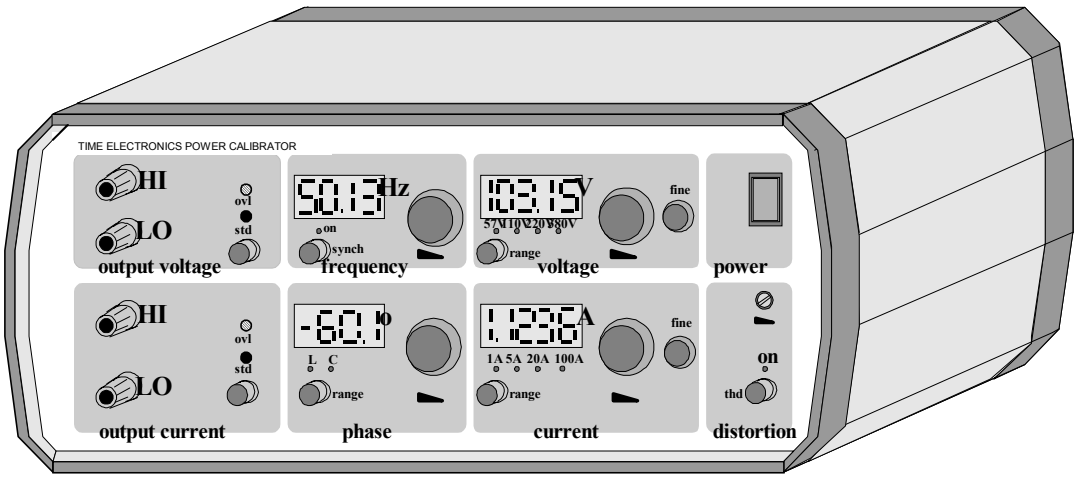

Fig.5.1. View of calibrator phase L1 front panel

"phase”	Phase angle between current and voltage signals is set up by the round knob. Pressing the pushbutton below the display causes change the range of phase. When the lamp ”L” light it determines the range from +0˚ to +90˚ and when the lamp ”C” light it determines the range from -0˚ to –90˚. In both case the value and sign of phase are shown on display.
"voltage”	Value of voltage signal is set up by two the round knob rough and fine. Pressing the pushbutton below the display causes change the range of voltage. The light lamp point at selected range 57V, 110V, 220V or 380V. Setting value of voltage is shown on display.
"current”	Value of current signals is set up by two the round knob rough and fine. Pressing the pushbutton below the display causes change the range of current. The light lamp point at selected range 1A, 5A, 20A or 100A. Setting value of current is shown on display, (switching on/off the 100A current range cause acoustic noise of 100A relay!)
"distortion”	Distortion of current and voltage signals are set up by mean of screw-driver. There are the pushbutton and the signal lamp of „thd”. Pressing the pushbutton causes change of lamp state. State switched on (light lamps) determines "thd" state, in which output voltage and current signal is deform from 1% to 15% total harmonic distortion. Distortion spectrum corresponds rectangular wave by triple frequency. State switched off the lamps determines pure sinewave output signals.

On the rear plate are:

- power supply socket 230V 10%, 50Hz 5%, 60Hz 5%,
- power supply fuse T 1,6A/250V,
- seal of calibrator,
- socket DB25 used to three phase set.

Power supply voltage and frequency must be consistent with the details specified within the technical data (Chapter 3). The calibrator has to be connected to the power supply voltage. To avoid shock hazard or instrument damage connect the calibrator line power ground to the earth ground. The connection need be made by factory-supplied, three-conductor line power cord. After that it has to be switched on (press "power” switch Fig.5.1).

After switching power the output current and voltage terminal are in standby state. The set value of current, voltage frequency and phase are shown the display. Warming up of the power-up calibrator should remain longer than 30 minutes. After this time calibrator is ready and all parameters according to Table 3.1 are guaranteed.

During exploitation calibrator will not demand regulation and calibration. Admissible values of setting signal described are in Table 3.1 and are definite for 12 months from last calibration. In case using the calibrator after longer time than 12 months from last calibration, one should take into account typical twice increase of errors in the next third years of exploitation and quadruple increase of errors in the next ninth years of exploitation.

Ways of load connection (for example checked meter) to the calibrator are presented in Fig.5.2.

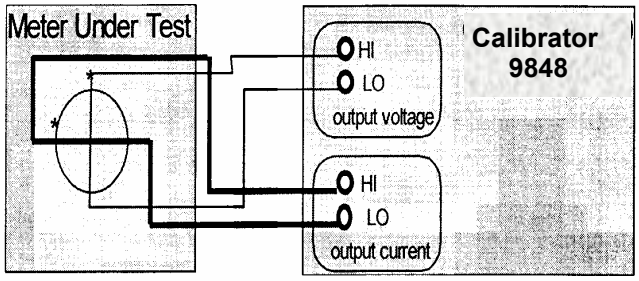

Fig. 5.2. Connection of wattmeter to calibrator terminals (single phase connection with calibrator Phase L1)

During applying load one should comply guidelines taken down in p.4. Overload current or voltage output is signalled with flashing lamps "ovl", after what follows automatic passage calibrator in to state standby. State standby is signalled by flashing lamps "std". Overload voltage output can be caused with connecting loads with too small resistance. Overload current output can be caused with connecting loads with too large resistance. Overload both output can be also caused with connecting non-linear loads.

The average rectified value of alternating signals is stabilized on the calibrator output but it is calibrated for sinusoidal signals RMS. Accuracy of voltage, current and phase angle are described in Table 3.1. They are true when the distortions are low and lamps "thd" is switched off.

6. Three Phase Calibrator Set

The 9848 can work in three phase set. (See Fig. 7.1.) It consists of one calibrator basic configuration (Phase L1) and two calibrators in special configuration (Phase L2 and Phase L3). Calibrator Phase L1 controls Phase L2 and Phase L3 by means of analogue and digital signal via connection at rear panel of calibrators.

Fig. 7.1. View of Three Phase Calibrator 9848 front panels

The three phase calibrator set is able to generate a symmetrical and asymmetrical three phase vector represented on Fig. 7.2, programmed from control calibrator Phase L1 and from calibrators Phase L2 and Phase L3. Shift angle between voltage signals L2 and L1 is programmed from range 110° - 130° and is indicated on display calibrator Phase L2. Shift angle between voltage signals L3 and L1 is programmed from range 230° - 250° and is indicated on display calibrator Phase L3.

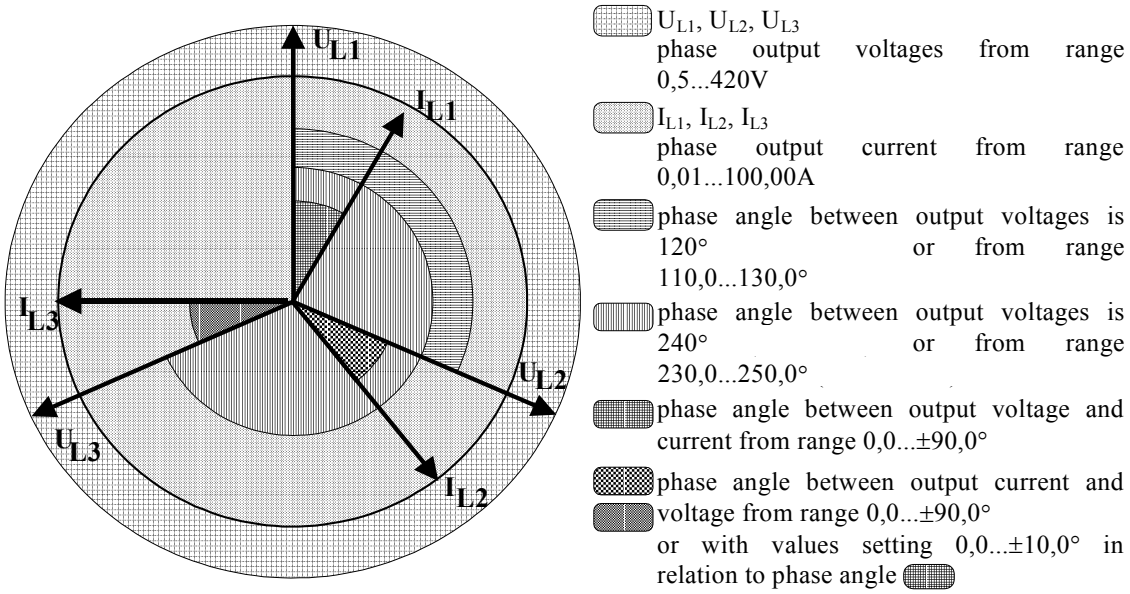

Fig. 7.2. Three phase vector of 9848 calibrators

Connection of three phase power meter to calibrator 9848 is shown in Fig.7.3. Low potential voltage "LO" of all three calibrators are connected by wire. This requirement refers to all of checking systems - system three- and four wire or Arona's system.

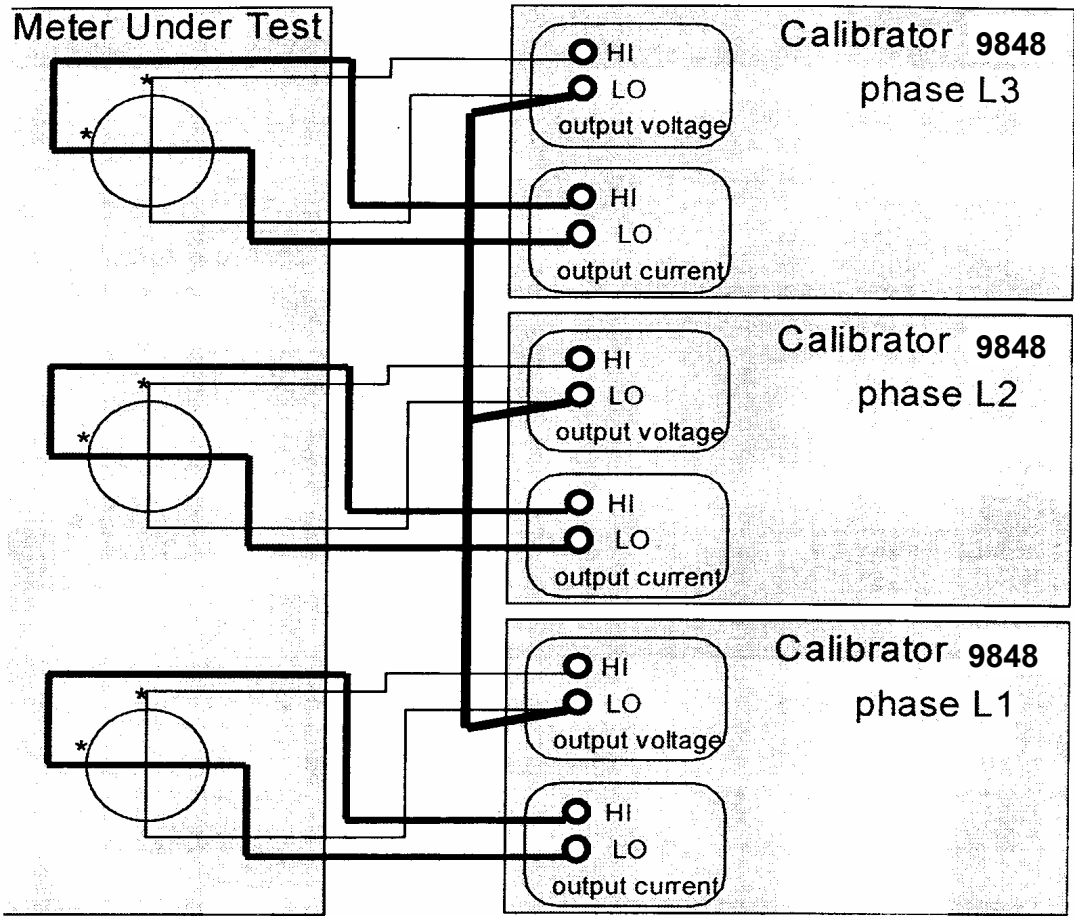

Fig. 7.3. Connection of three phase power meter to 9846 calibrator

7. Equipment

A complete 9848 calibrator set consists of:

Calibrator is basic configuration with power cable …….. 1 piece
Calibrator in configuration Phase L2 with power cable …….. 1 piece
Calibrator in configuration Phase L3 with power cable …….. 1 piece
Bus wire …….. 1 piece
Fuse T 1,6A/250V ……..…… 3 pieces
User's Manual ……..... 1 piece

8. Guarantee & Service Facilities

The unit is guaranteed for a period of one year from its delivery to the purchaser.

We maintain a comprehensive after sales service and the instrument can, if necessary, be returned to us (or our authorised dealer) for servicing. The type and serial number of the instrument should always be quoted in all correspondence, together with the details of any fault found and the service required.

Equipment returned to us for servicing must be adequately packed, preferably in the box supplied, and shipped with transportation charges prepaid.
WE CAN NOT ACCEPT RESPONSIBILITY FOR ANY INSTRUMENT ARRIVING DAMAGED.

Should the cause of failure during the guarantee period be due to misuse or abuse of the instrument, or if the guarantee period has expired, the repair will be put in hand without delay and charged unless other instructions are received.