Dear User,

We congratulate you and thank you for choosing Schneider Electric Conzerv.

The EM 3460 series of smart instruments offer comprehensive three-phase electrical instrumentation and load management facilities in a compact and rugged package.

To fully appreciate your EM 3460 instrument and get the best out of your investment, we suggest that you take time to study this handbook.

Schneider Electric Conzerv stands behind your EM 3460 with complete user support and service. Please contact us with all your queries. The contact details are listed in Appendix C at the end of this handbook.

The products described herein contain several features and user programmable settings. Since the programming and usage of the products and/or this handbook are beyond the control of Schneider Electric Conzerv, the user must ensure that these are aptly done to suit his application. Schneider Electric Conzerv is not liable for any loss, direct or consequential, arising from the use of the products or the material in this handbook.

Schneider Electric Conzerv India Pvt Ltd 44P Electronic City East Phase, Hosur Road Bangalore – 560100 INDIA	Phone:+ 91(80) 3910 2730 Fax : + 91(80) 3910 2735 Help Desk 1800 425 0555 (Toll Free All India from BSNL/MTNL Lines) Or Call +9180 2852 0604 (Standard Charges Apply) email: contact@conzerv.com **Website: www.conzerv.com**

NOTE 1: Additional copies of this handbook may be ordered from Schneider Electric Conzerv, by registered EM 3460 customers. Contact Schneider Electric Conzerv for availability.

Table of Contents

UNPACKING

First, examine the outer carton in the presence of the transporter. On any signs of damage or liquid spills, notify the transporter before unpacking. Please also read the SCHNEIDER ELECTRIC CONZERV Warranty in Appendix B.

Please do not remove the protective plastic cover of your new instrument until the time of installation. Retain the packing material, which may be required if your EM 3460 needs to be shipped later for service or calibration.

1. INTRODUCTION

1.1. COMPREHENSIVE THREE-PHASE INSTRUMENTATION

EM 3460 offers high accuracy, reliability and ruggedness, as well as real value for money. This next-generation micro-processor based instrument monitors over 25 vital parameters and replaces over 20 individual transducers and meters, for comprehensive Load Management in 3-phase commercial and industrial applications.

The EM 3460 offers comprehensive power and energy monitoring at feeders and individual loads. In addition, offers demand monitoring and control. If ordered with the import-export option -IE, the EM 3460 can monitor exported energy parameters. See “PARAMETER LIST” on page 48 for more information.

1.2. EASY INSTALLATION

The EM 3460 is panel-mounted and has reliable, rear-mounted terminal strips rated at 600 v. The 186 x 138 mm cut-out and a 192 x 144 mm bezel dimension adheres to DIN 43700 and IS 2419-1979. Depth required behind the bezel is 110 mm, plus space for wiring. Four corner clamps are provided for firm mounting.

1.3. INFORMATIVE DISPLAYS

The EM 3460 monitors over 25 parameters and records more than 200 items of information. These are quickly accessed by seven smart-keys on the front panel via a simple user interface, and displayed on a large, 14 mm, highly visible LED display. The EM 3460 features an anti-glare front panel for improved readability.

	Parameter	**EM 3460**
1	**System and Phase values**	
	V (Voltage)	Y
	A(Current)	Y
	KVA (Apparent power)	Y
	KW (Active power)	Y
	KVAR (Reactive power)	Y
	PF (Power factor)	Y
2	**Line to neutral voltage**(Line to star point is computed for 3 wire delta systems)	Y
3	**Neutral to Earth voltage**(4 wire only)	Y
4	**Frequency**	Y

	Parameter	EM 3460
5	**INTEG Values** kVAh kWh kVARh	 Y Y Y
7	**PFavg**	Y
8	**DM (Demand)** **Max DM (Maximum demand)**	Y Y
9	**Pd DM (Predicted Demand)** **Spare Load** **Demand Control output**	Y Y Y

Demand parameters can be field programmed for either kVA or kW demand.

A four-level PF LOCK allows you to match the EM 3460 response to your tariff or metering requirements, for leading PF, while accumulating kVARh, kVAh and kVA demand with EM 3460. This allows your EM 3460 to keep up with the latest international trends in metering. All voltage, current, power and energy readings are True RMS including harmonics. Measurements are full 4 quadrant for power parameters (kVA, kW, kVAR, PF). Energy (kVAh, kWh, kVARh), and EM 3460 demand readings are unidirectional with a built-in reverse lock, showing forward flow (Import by the consumer), to match with the EB(Electricity Board) tariff meter.

If you have ordered the -IE option, then Energy Export as well as Net (kWh, kVARh) and Total (kVAh, Avg PF) readings are additionally available and the PF LOCK operates as programmed, for the Export direction as well.

1.4. MANAGEMENT TOOLS

Average Power Factor, Average Voltage, Ampere Hours, Average Frequency, total Hours Run, Hours Off, the number of power Interruptions, Power On Time and Power Off time are also provided.

Moreover, the EM 3460 records a HiLo Profile containing 4 Highs (Maxima) and 4 Lows (Minima), for: VA, W, VAR, PF, V, A and F. The EM 3460 additionally record the HiLo Profile for demand and a demand profile of 19 demand levels and the number of times the demand has exceeded each level.

1.5. PHASE ANGLES

The EM 3460 displays the phase angles of voltage (V1, V2, V3) and current (A1,

A2, A3) fundamental vectors. This is a powerful tool for visualizing unbalances and is an instant check for wrong connections, reversed phase sequences, deteriorating power factor compensation on one of the phases, etc. This last problem often remains hidden due to over-compensation (Leading Power Factor) on the other two phases, but your distribution losses will be high.

1.6. POWER QUALITY ANALYSIS

%Total Harmonic Distortion (THD %) readings are available for the V1, V2, V3, A1, A2 and A3 waveforms. %THD readings are important with the increasing use of thyristor controlled, non-linear loads. High %THD readings (greater than approximately 10% depending on any governing laws and your equipment specifications), warn you of over-heated motors and impending damage to equipment not rated for high harmonic currents, like power factor correction capacitors and even your neutral wiring. Proper filtering to reduce harmonics emanating from your loads to acceptable levels will improve matters. SCHNEIDER ELECTRIC CONZERV's Power Systems Group offers services in this area.

1.7. EM 3460 DEMAND CONTROL WITH PREDICTION

Auto - Sliding window, RTC and User – Fixed window modes are available for VA / W DM control.

Table 1.7.1 below describes demand control features for EM 3460.

Features	EM3460
Demand Measurement	Y
Maximum Demand with Occurrence date and time	Y
Profile Demand	Y
Prediction DM and Spare Load (refer Note 1)	Y
Output relays (See “CONTROL OUTPUTS” on page 7 for more information) and control parameters	Y

For further details please refer to “Table 3.4.2.1” on page 37 Full Setup Settings.

1.8. FAST RESPONSE

The EM 3460 carries out rapid real-time measurements. All instantaneous, power and INTEG parameters displays update every 1 second. Demand Parameters are updated on the display every 15 Seconds.

1.9.CONTROL OUTPUTS

The EM 3460 provides three change-over relay outputs for the following conditions:

SHED. Indicates that load shedding is required.
See DM>UL and PdDM>UL

RESTORE. Indicates that loads may now be restored.
Additional load allowed, is shown by SprLD (+ve).

PdDM>UL. Indicates that demand is predicted to exceed
Upper Limit (UL) within programmed Prediction Interval (PdIN). Load Shedding by the amount shown by SprLD (-ve) is necessary to keep demand within the programmed Upper Limit (UL). Alternatively, transfer excess load to an in-house generator. The Prediction Interval (PdIN) provides valuable advance notice for this operation.

These outputs can be wired to remote annunciators, or can be used for automatic operation of circuit breakers via a control contactor.

1.10. FULLY FIELD PROGRAMMABLE

While ordering for EM 3460, apart from the options, primarily the auxiliary voltage (standard: 240v ac, ordering option: 110v ac) and the current input (standard: 5A, ordering option: 1A) must be specified. The remaining settings like the choice of 3 Wire or 4 Wire measurements, PT and CT primary values, demand control limits , date, time, etc. are field programmable through a setup menu, this makes ordering and installation simpler and you can just re-program your EM 3460 as per your changing needs.

1.11. SELECTION OF VA CALCULATION (3D & ARITHMETIC)

By default the product is shipped with 3d VA, user can select these options through the front panel key.
Table 1.11.1 below contains VA calculation options available with EM 3460.

VA function display in Set up	**Formula**	**Other Names**	**Which one?**
3d (default)	$\sqrt{\Sigma W1^2 + \Sigma VAR1^2 + \Sigma D1^2}$	U, Apparent, Vectors	Best All round
Arth	$\sqrt{\Sigma V1 * A1}$	Arithmetic	Good under low unbalance

1.12. TIME OF USE (TOU):

Time of use is a structure where energy consumption (kVAh, kWh, kVARh) at different user programmable time intervals can be stored in separate registers. This is useful wherever the power tariff changes with the time of consumption. Thus consumers can reschedule their processes to off peak hours to reduce the power costs (See “Appendix F” on page 63 for more information). **For E.g.**: 09:00:00 to 16:59:59 is the peak hour, where the tariff may be higher, 17:00:00 to 21:59:59 is average consumption where the tariff may be less than the peak hour

and 22:00:00 to 08:59:59 is the off peak hour where the tariff may be the lowest. Also refer to “Appendix F” on page 63 for more information.

Table1.12.1 below illustrates type of TOU and other inbuilt functions.

TOU Options	**EM 3460 IE & EM 3460**
TOU option Enable	At factory
TOU set up through setup utility (ConPAD) at regional service center/sales	TOU tariff timings and DM control limits
TOU set up through front panel	DM control limits
Energy TOU	9 INTG[2] + 9 Max DM REGs
Demand Control TOU	Max . 8 UL and LL per day selectable from predefined 16 sets of UL & LL
Max. no. of non- overlapping seasons per year	6
Max. no. of non- overlapping tariff time zones per day	8
Max. no. of INTG	1 (24 hrs Main INTEG) + 8 (TOU Sub INTEG)

Notes:
*1: Reprogramming of TOU tariff time settings is required whenever EB TOU tariff duration changes and in case of Indian calendar based on the public holidays.
*2: INTEG – VAh, Wh, VARh, Ah, Pfavg, Vavg, Favg, Run Hours and Max DM (EM3460 only).

1.13. AUTO RESET:

Auto Reset is feature to clear or reset the INTEG (accumulated values) to zero on a pre-programmed date and time. The existing INTEG values will be stored in the OLD registers and fresh values are accumulated in the INTEG. This feature is only applicable for INTEG, not for HI Lo profiles. Also refer to “Appendix F” on page 63 for more information.

1.14. ACCESSORIES

While the EM 3460 has been designed for panel mounting, the precision and wealth of information recorded by it has encouraged many users to apply it in the field as a portable instrument, in the lab as a test-bench instrument and for teaching electrical three-phase systems. For such applications, you may find SCHNEIDER ELECTRIC CONZERV's range of Clip-on voltage and current probes to be very useful accessories, ensuring quick, safe and reliable connections, without disturbing the load. The SCHNEIDER ELECTRIC CONZERV voltage probes are HRC fused for safety. The current probes are available with a full scale of 1000A, 500A, 200A or 100A to suit your needs. Since the error of external probes / transformers adds to the basic instrument error, the SCHNEIDER ELECTRIC CONZERV probes offer precision amplitude and phase characteristics to suit the EM 3460 family.

2. INSTALLATION

2.1. INTRODUCTION

This chapter describes the following:

a) Selecting the EM 3460 location and mounting.

b) PT, CT, auxiliary supply and control relay wiring.

c) Maintenance, calibration and field service.

DANGER

DURING NORMAL OPERATION OF THIS INSTRUMENT, HAZARDOUS VOLTAGES ARE PRESENT AT THE REAR TERMINALS, WHICH CAN CAUSE SEVERE INJURY OR DEATH. THESE VOLTAGES ARE PRESENT THROUGHOUT THE POTENTIAL TRANSFORMER (PT), CURRENT TRANSFORMER (CT), AUXILIARY SUPPLY AND CONTROL RELAY CIRCUITS. INSTALLATION, DISCONNECTION OR REMOVAL OF THE SHOULD BE CARRIED OUT ONLY BY QUALIFIED, PROPERLY TRAINED PERSONNEL, AFTER DE-ENERGISING CONNECTED CIRCUITS.IMPROPER INSTALLATION, INCLUDING IMPROPER WIRING AND / OR IMPROPER GROUNDING, WILL VOID SCHNEIDER ELECTRIC CONZERV'S WARRANTY.

DANGER

THE COVERS OF THE EM 3460 SHOULD NEVER BE DISMANTLED OR OPENED. THERE ARE NO USER-SERVICEABLE PARTS INSIDE. THE EM 3460 CONTAINS HIGH-PRECISION COMPONENTS WHICH REQUIRE SPECIAL HANDLING AVAILABLE ONLY AT AUTHORIZED SCHNEIDER ELECTRIC CONZERV SERVICE LOCATIONS. HIGH VOLTAGES ARE LIKELY TO BE PRESENT INSIDE EVEN AFTER THE EM 3460 HAS BEEN SWITCHED OFF. OPENING THE COVERS OF THE EM 3460 AND / OR ANY ATTEMPTS TO DISMANTLE, SERVICE, REPAIR OR MODIFY THE UNIT BY UNAUTHORIZED PERSONS MAY CAUSE SEVERE INJURY, DAMAGE THE UNIT AND ALSO RENDER SCHNEIDER ELECTRIC CONZERV'S WARRANTY VOID.

2.2. FULL - SETUP (FIELD PROGRAMMING)

The EM 3460 allows user programming of several settings through the Setup Menu. The Full-Setup must be done before connecting the load, with only the Auxiliary Supply connected (see "Auxiliary Power Supply Connections" on page 15 for more information). Refer to "Full-Setup procedure" on page 11 for more information.

Once the voltage and current signals are wired, the EM 3460 allows only a Partial-setup and the critical settings (such as choice of Star (4 wire) or Delta (3 wire)

system, 2 Element or 3 Element measurement, PT and CT settings, etc.), may only be viewed, but cannot be changed.

2.3. LOCATION

2.3.1. Usage

First, decide on how the EM 3460 is going to be used. If you do not already have an Energy Management Program in operation, then your Energy Consultant should be able to help you identify which load(s) offer maximum savings potential.

This will help you decide:

a.) Which point is to be monitored?

b.) Where the readings will be viewed from

c.) Who must have access to the instrument and how often.

For best performance, choose a location which provides all the required signals with minimum wiring lengths.

The EM 3460 provides 3 output relays with change-over contacts for demand control. If these are going to be used, then they will typically be:

a.) Wired to a local annunciator panel or,

b.) Extended to remote annunciators, and / or,

c.) Used for automatic tripping via control contactors wired to a circuit breaker.

CAUTION

IN PLANNING THE CONTROL OUTPUT USAGE, ENSURE THAT THE EM 3460 OUTPUT RELAY RATINGS ARE NOT EXCEEDED. IF THESE WILL DRIVE THE COIL OF AN AUXILIARY CONTROL CONTACTOR, THEN THE SPARK QUENCHER SUPPLIED WITH YOUR EM 3460 MUST BE CONNECTED IN PARALLEL WITH THE CONTACTOR COIL. OTHERWISE, THE COIL'S INDUCTIVE SPIKES WILL BURN OUT THE EM 3460 OUTPUT RELAYS AND SCHNEIDER ELECTRIC CONZERV'S WARRANTY WILL BE VOID.

CAUTION

THE EM 3460 MUST BE CONNECTED TO MONITOR THE INCOMING FEEDER. ALSO, THE EM 3460 DM>UL DEMAND CONTROL OUTPUT SHOULD TRIP THE ENTIRE LOAD CONNECTED TO THE INCOMING FEEDER AND NOT JUST A PARTIAL LOAD. OTHERWISE, THE DEMAND WILL CONTINUE TO RISE AND YOU WILL INCUR A MAXIMUM DEMAND PENALTY.

2.3.2. Panel Considerations and Environment

The EM 3460 is a high-precision measuring instrument and its operating environment is of utmost importance. For maximum performance, the instrument should be mounted in a dry, dust-free location, away from heat sources and strong electromagnetic fields. To operate reliably, the following conditions must be met:

Storage Temperature	(-20^0 - 70^0 C)
Operating Temperature	(0^0 - 60^0 C) ambient.
Relative Humidity	Max 95% non-condensing.

The EM 3460 should be separated from other power equipment and sufficient space must be provided all around for cooling air to rise vertically past the instrument. The cooling air temperature must be below the specified operating temperature.

The panel or housing, in which the EM 3460 is mounted, should protect it from dust, moisture, oil, corrosive vapours, etc.

The panel doors must ensure easy access to the EM 3460 wiring for trouble-shooting. Allow clearance if the unit is going to swing out, as well as adequate slack in the wiring. Allow space for terminal blocks, shorting blocks, auxiliary contactors and other necessary components.

2.3.3. Viewing

For ease of operation, the location should be preferably at, or slightly above, eye-level. For viewing comfort, minimize glare and reflections from strong light sources.

2.4. MOUNTING

Before mounting and wiring, the Full-Setup procedure should have been completed. See “FULL - SETUP (FIELD PROGRAMMING)” on page 11 and “Servicing” on page 30 for more information. The EM 3460 is panel mountable.

Panel cutout	$186^{+1.0}_{-0}$ mm (w) x $138^{+1.0}_{-0}$ mm(h) DIN 43700 and IS 2419-1979
Panel thickness	0.5 to 4.0 mm
Instrumental bezel dimension	192 x 144 mm
Depth behind bezel	110 mm (leave clearance for wires)
Mounting clamp screws	Phillips (Star), 4 nos.
Terminal screws	Combination Phillips & slotted head

The cut-out should be punched with the proper tool and should be free from burrs.

NOTE: Instead of a 186 x 138 mm punch, two accurately spaced operations of a 138 x 138 mm punch may be used.

Before wiring, insert the EM 3460 into the cut-out from the front. Then, fasten the

four corner clamps from the rear, along with the retaining ring. While supporting the EM 3460 from the front, tighten all four clamp screws in a criss-cross pattern till all slack is taken up, then apply one full turn. Do not over-tighten.

A Phillips (star) head screwdriver (such as Taparia 862) in good condition is recommended, to avoid damaging the screw heads. The same screwdriver may be used for the terminal block.

2.5. WIRING

2.5.1. PT and CT Selection and Wiring Considerations

The accuracy of measurement is determined by the accuracy and phase-shift of the PTs and CTs. Instrument Class 1 or better PTs and CTs are recommended. Do not use Protection Class (10P10, etc.) CTs (they have poor accuracy and phase characteristics) to feed the EM 3460. Ensure that the CT primary rating has been selected so that your normal load variation lies between 40% to 80% of its full scale. If your CT is over-rated, and say only 3% to 10% of its full scale is utilized, accuracy suffers. Moreover, the EM 3460 control settings cannot be programmed for very low values. On the other hand, if the CT is under-rated, then you may exceed its full-scale and burn out both the CT and the EM 3460.

The PT's and CT's must have adequate VA rating to support the burden (loading) on the secondaries. You may want to support the auxiliary supply burden from one of the PTs. CT wiring can impose additional burden (loading) on the CT. For example, if the CT has a 5A secondary and the wire resistance is 1.0Ω, then the CT has to support an additional burden of 5VA. If the wiring distance from the CT secondary is greater than say 2 meters, then a 5A CT could get over-burdened and give large errors; a 1A CT secondary is recommended.

The EM 3460 should be conveniently located for connections to the voltage (PT) and Current (CT) signals, the auxiliary supply (usually derived from the voltage signals), the EM 3460 control relay outputs and most important, a good grounding point. Also see servicing on page 30 for more information.

NOTE 1: The EM 3460's field programmable PT and CT primary settings may be utilized to calibrate out the PT and CT amplitude full-scale error, for improved accuracy.

NOTE 2: With dual - range CT's, select the best range for programming the EM 3460. Do not change the range thereafter; the EM 3460 will read erroneous values.

2.5.2. Earth (Ground) Connection: Protection and Shielding

For best grounding connection, use a dedicated solid copper wire of at least 14 gauge. Remove any oxide film at the wire ends using sand-paper and crimp a spade lug for connecting reliably to the EM 3460 terminal block. The other end of the ground wire must be tightly bolted to the ground point. The ground point should be selected for hard grounding and minimum errors due to distribution voltage drops. Alternatively, use a 40/36 multi-strand tinned copper wire. Thick multi-strand wire provides the worst grounding for spikes.

CAUTION

PANEL DOOR HINGES DO NOT PROVIDE A RELIABLE GROUND PATH. CONNECT THE GROUNDING WIRE FROM THE EM 3460 DIRECTLY TO THE PANEL-FRAME GROUNDING BOLT, AND NOT TO THE DOOR.

CAUTION

THE EARTH TERMINAL OF EM 3460 MUST BE CONNECTED TO A RELIABLE, LOW IMPEDANCE EARTH GROUND POINT. IF THIS IS NOT DONE, THE SURGE PROTECTION IN THE EM 3460 AS WELL AS ITS ELECTRO-MAGNETIC SHIELDS WILL NOT OPERATE, RESULTING IN MALFUNCTIONING OF EM 3460.

DANGER

FAILURE TO PROVIDE PROPER GROUNDING WILL CAUSE THE EM 3460 TO MAL-FUNCTION AND WILL VOID WARRANTY.

2.5.3. Auxiliary Power Supply Connections

The EM 3460 requires a single-phase ac, 50/60 Hz auxiliary power supply to supply power to its electronic circuitry. There are two auxiliary supply terminals. The live (Hot) wire goes to the L1 terminal. Before any other connections are made, the full-setup procedure must be completed, with only the auxiliary supply applied. See “FULL - SETUP (FIELD PROGRAMMING)” on page 11 for more information.

EM 3460 auxiliary supply burden: 5 VA Max, 240v (or 110v) ac, 50/60 Hz.

For 440v LT systems: Order the EM 3460 with a standard 240v ac supply which can be tapped from line and neutral.

For 110v HT systems: Order the 110v auxiliary supply option. The 110v ac supply can be tapped directly from one 110v PT secondary.

NOTE 1: The auxiliary power supply must be derived from the voltage signals. See “INTEG:” on page 44 for more information.

NOTE 2: If you have a 440v three-wire delta system and a reliable neutral is not available, a 440v:240v supply transformer should be used to provide the standard 240v auxiliary supply. Such a transformer may be ordered from SCHNEIDER ELECTRIC CONZERV. Contact your SCHNEIDER ELECTRIC CONZERV representative for availability.

DANGER

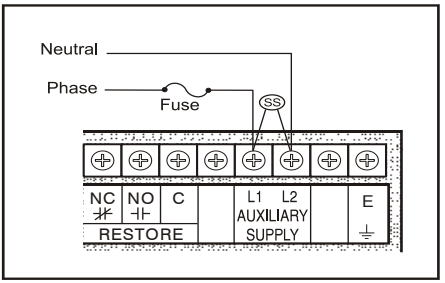
DO NOT FEED THE EM 3460'S AUXILIARY POWER SUPPLY TERMINALS WITH A VOLTAGE GREATER THAN THE RATNG MARKED ON THE LABEL. THE EM 3460 WILL BE PERMANENTLY DAMAGED AND SCHNEIDER ELECTRIC CONZERV'S WARRANTY SHALL BE VOID.

2.5.3.1. Surge Suppressor (Spark Quench):

An external surge suppressor (an MOV) is supplied, to suit your EM 3460's operating voltage (110v / 240v). This must be firmly fitted at the EM 3460 auxiliary supply terminals, in parallel with auxiliary supply wiring. See Fig 2.5.3.1.1.

PLEASE ENSURE THAT A SERIES FUSE HAS BEEN PROVIDED IN THE AUXILIARY SUPPLY.

With transients above its rating, the suppressor will self destruct (short) to protect the EM 3460. Replacement of surge suppressor is **not** covered under Warranty and must be done by the user to ensure continued operation.



e) Surge Suppressor (MOV) for Auxiliary Supply

Fig 2.5.3.1.1 Fuse & Surge Suppressor at EM 3460 Aux Supply Terminals

2.5.4. Voltage Signal Connections

There are 4 voltage input terminals marked V1, V2, V3 and Vn. Any unused voltage input terminals must be connected to ground and must not be left open. See the wiring diagrams that follow, for details.

CAUTION

BEFORE WIRING, DE-ENERGIZE THE PT SECONDARY BY OPENING THE CIRCUIT OR REMOVING THE SECONDARY FUSE. DO NOT SHORT THE PT SECONDARY.

Field programmable PT primary range : (0.1 - 999 kV) ac L-L.

Field programmable PT secondary range : (100 - 600v) ac L-L.

EM 3460 voltage input burden : 0.2 VA Max per input.

See the "setup (field programming)" on page 11 for more information.

2.5.5. Current Signal Connections

The standard EM 3460 comes equipped with 5A ac current inputs for connection through a 5A Current Transformer (CT). If your CT has a 1A secondary or you plan to use your EM 3460 as a portable unit with SCHNEIDER ELECTRIC CONZERV Clamp-On current probes, a 1A option.

There are three pairs of current input terminals marked A1 (S1, S2), A2 (S1, S2) and A3 (S1, S2). For proper measurements, the phase identification as well as the polarity of the current signals must be correct. The forward flow (Import by consumer) current direction must be into the S1 terminal and the exit from the S2 terminal. Any unused current input must have its two terminals (S1, S2) shorted together and preferably also grounded.

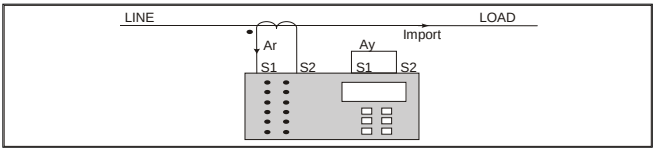


Fig. 2.5.5.1- Diagram showing A1 Line to Load direction. Note unused A2 input. Only relevant EM 3460 terminal block connections are shown.

> **CAUTION**
>
> BEFORE WIRING, DE-ENERGIZE THE CT SECONDARY BY SHORTING IT VIA A SHORTING BLOCK. UNDER NO CIRCUMSTANCES MUST THE CT SECONDARY BE OPEN-CIRCUITED, EVEN BRIEFLY.

Field programmable CT primary range : 1 to 30,000A ac.

CT secondary : 5 A ac standard (1A ordering option)

EM 3460 CT burden : 0.2VA max per input.

See “SETUP (FIELD PROGRAMMING)” on page 11 for more information.

2.5.6. Determining System Type for Setup Programming

The EM 3460 requires to know the type of three phase system that it is connected to. This is programmed in the Full-Setup procedure described in Chapter 3. Table 2.5.6.1 shows how to select the correct system type. The system type consists of the measurement mode (Star 3E, Delta 2E or Delta 3E) and the signal mode (4V3A, 3V3A or 3V2A). Other combinations are primarily meant for testing and educational use and are not suitable for tariff related use.

Table 2.5.6.1 - System Type for Set-up Programming

CONNECTED SIGNALS		SETUP SYSTEM TYPE	APPLICATION
V1 V2 V3 Vn	A1 A2 A3		

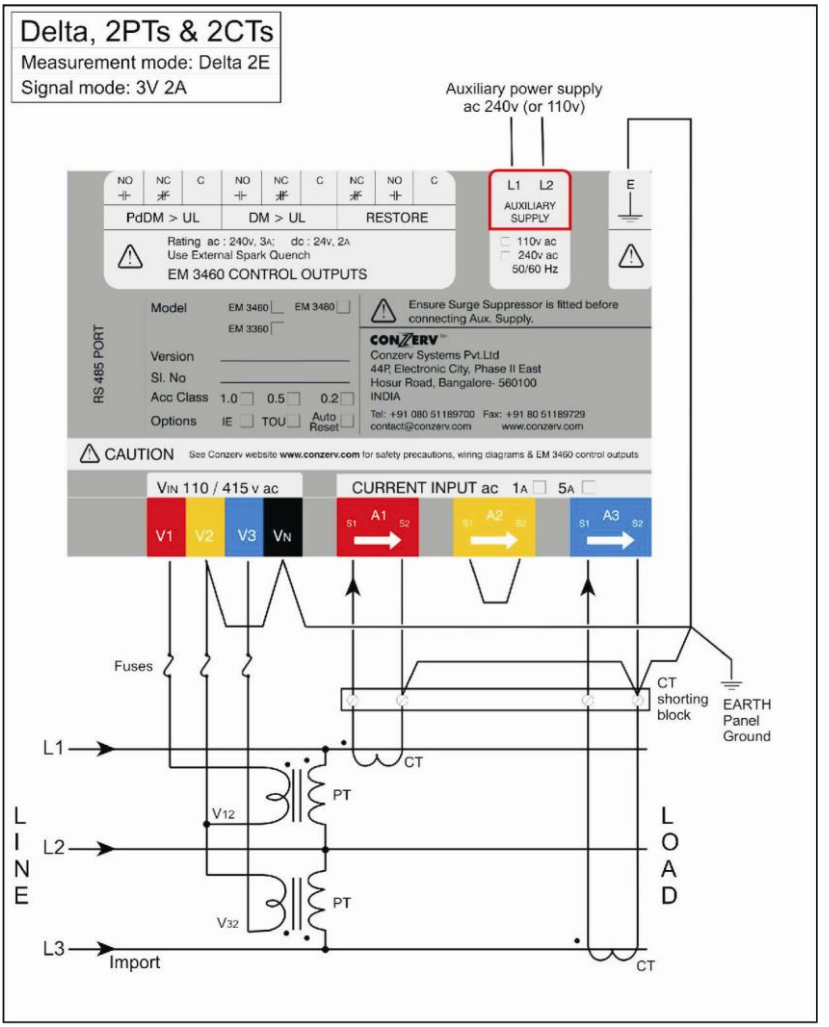
CONNECTED SIGNALS							SETUP SYSTEM TYPE	APPLICATION
Y	Y	Y	Y	Y	Y	Y	Star3E 4V3A	For 3 element (Wattmeter) measurement of all 4 wire systems (with Neutral)
Y	(Y)	Y	Y	Y	Gnd	Y	Delta2E 3V2A	For 2 element measurement of 3 wire systems without A2 CT. A2 is computed
Y	Y	Y	Gnd	Y	Y	Y	Delta2E 3V3A	3 wire systems with A2 CT.
Y	Y	Y	Gnd	Y	Y	Y	Delta3E 3V3A	3 element measurement of 3 wire systems where phase-wise power is important. But accuracy is less than Delta 2E, especially if the system is highly (>10%) unbalanced

2.5.7. Connection Diagrams

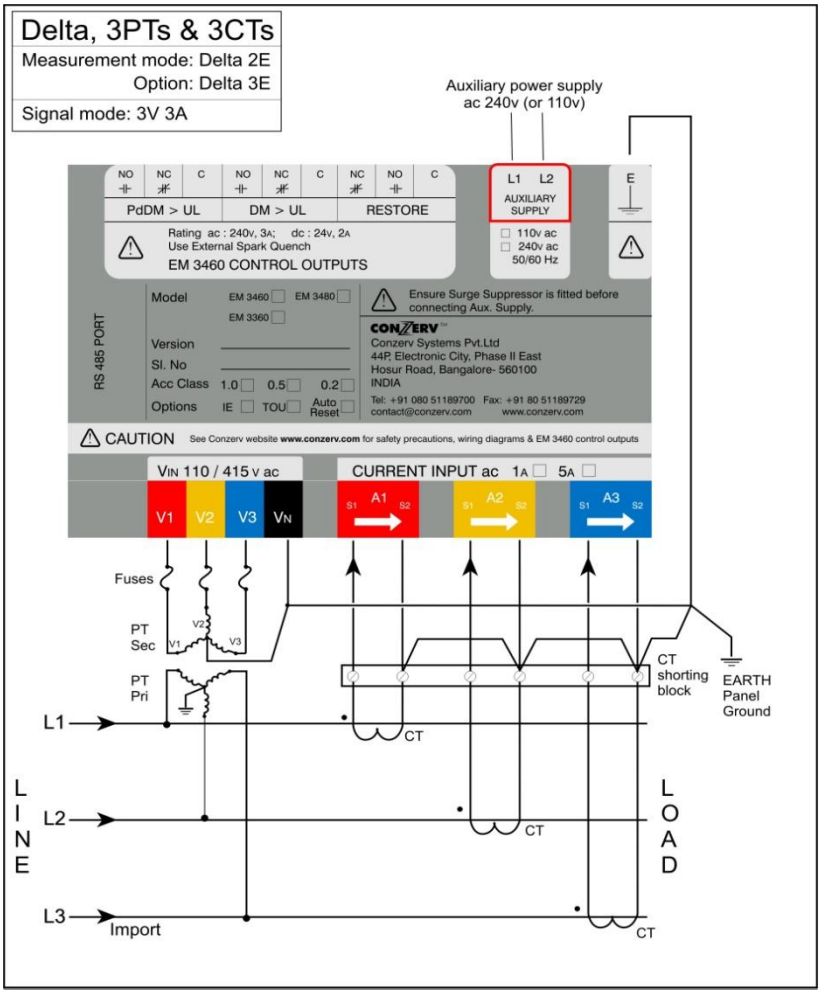
Refer Section 2.5 on Wiring before proceeding. Also, note that:

1. If signals must be looped to other equipment, then current inputs must be in series and voltage inputs must be in parallel. However, first check all the polarities and ratings.
2. Voltages upto 440v ac L-L (250v L-N) with 25% overload capability, upto a maximum of 600v ac L-L (330v L-N) may be connected directly to the EM 3460 voltage inputs. Voltages greater than this typically HT systems must be connected through potential transformers (PT's). The EM 3460 allows field programming of both the PT primary and PT secondary voltages. With direct voltage connection (no PT's), programme Vsec= Vpri. Typically Vpri= 0.415 kV and Vsec= 415v for Asia.
3. Current inputs must be connected through CTs. The CT secondary may be 1A or 5A. The EM 3460 current input must be selected accordingly at the time of ordering. See “Current Signal Connections” on page 16 for more information.
4. PT and CT secondaries MUST be grounded for safety.

2.5.7.1. Three Phase 3 Wire (Delta) HT Systems with 2 PT's and 2 CT's

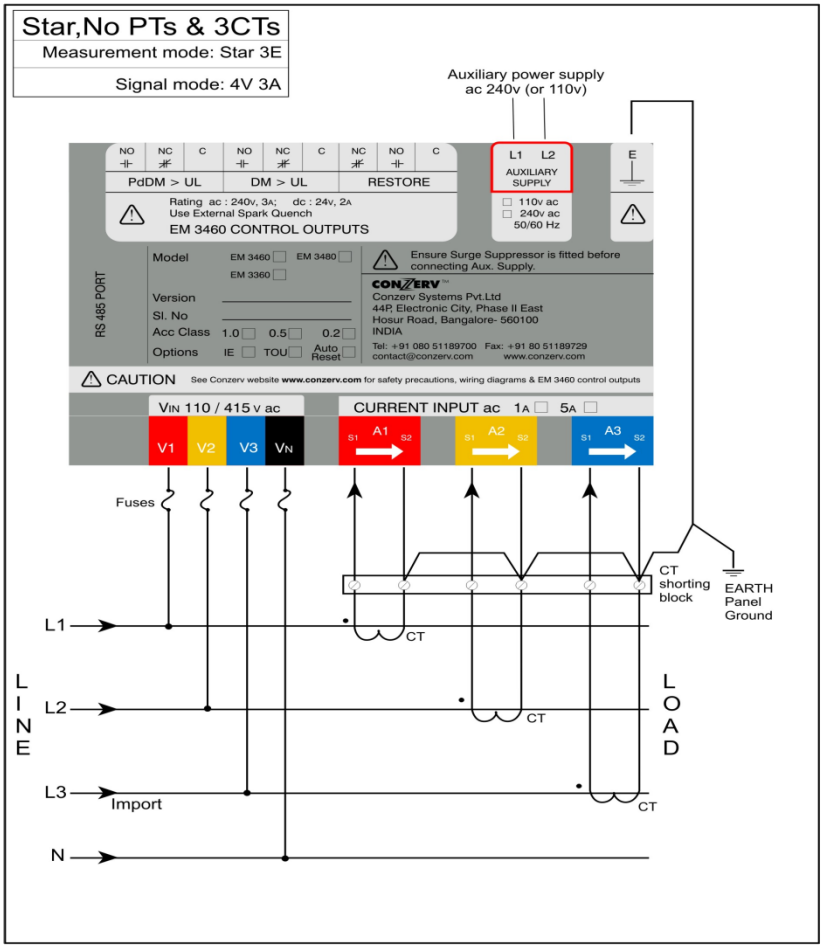


2.5.7.2 Three Phase 3 Wire (Delta) HT Systems with 3 PT's and 3 CT's



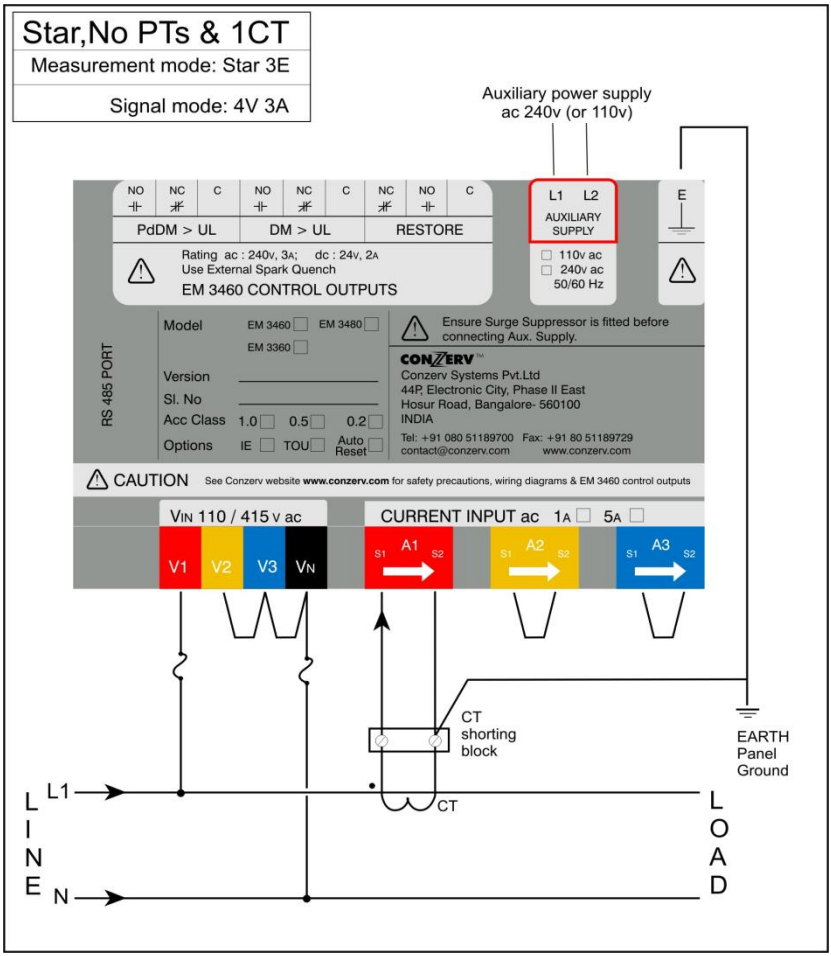
NOTE 1: PTs are required for voltages greater than 440v ac L-L (600v ac L-L max).

2.5.7.3 Three Phase 4 Wire (Star) LT Systems with Direct Voltage Connections (Voltages less than 600v ac L-L) and 3 CT's.



NOTE 1 : With a direct voltage connection (no PTs), programme Vsec = Vpri.
Typically, Vpri = 0.415kv, Vsec = 415v

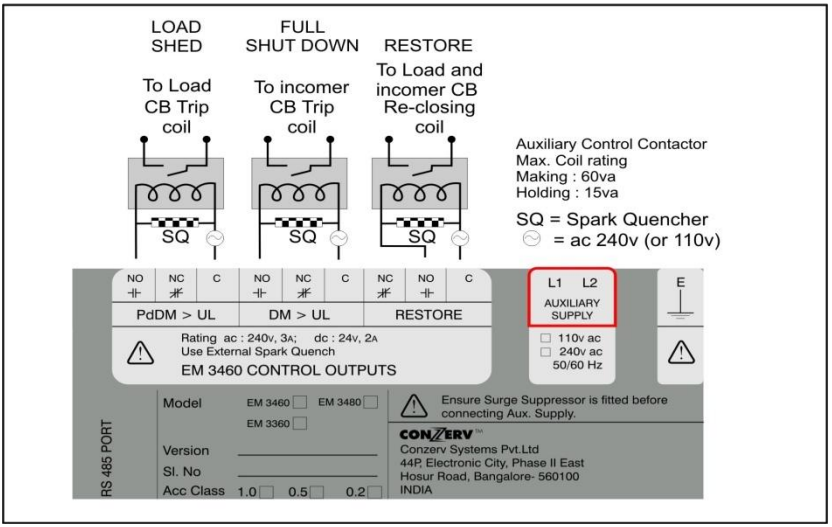
2.5.7.4 Single Phase 2 Wire LT Systems with Direct Voltage Connections (Voltages less than 340v ac L-N)

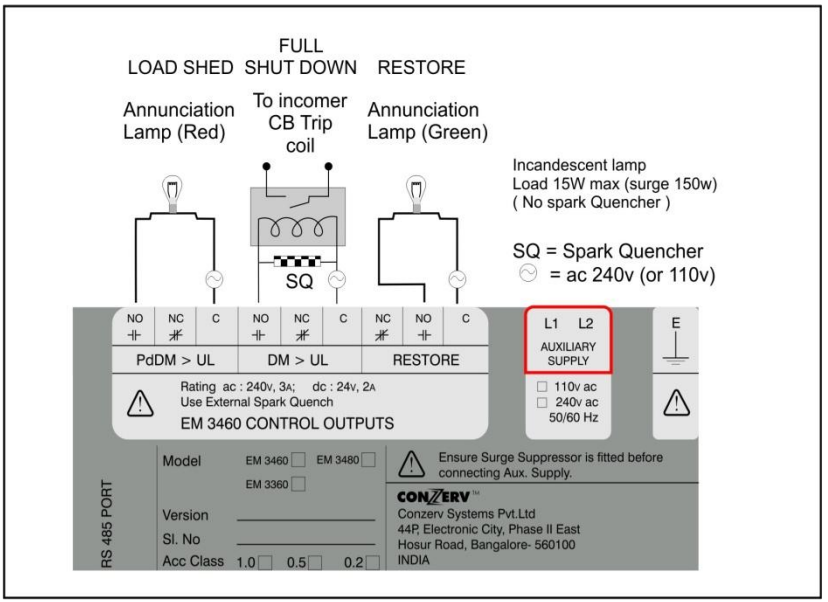


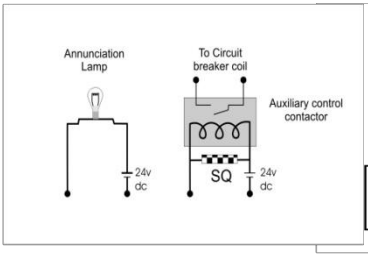
NOTE 1: With a direct voltage connection (no PT's), Programme Vsec = Vpri. Typically, Vpri = 0.415kv, Vsec = 415v.

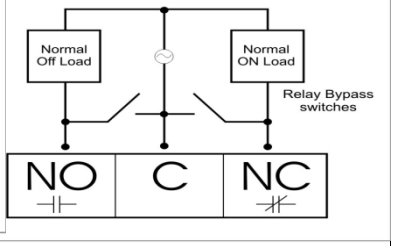
NOTE 2 : For V and A, the Phase 1 value should be viewed. Vavg and Ah (INTEG) will be 1/3rd of the correct value. All the remaining parameters will be measured correctly.

2.5.7.5 EM 3460 Demand Control Output Connections









CAUTION

THE EM 3460 MUST MONITOR THE **INCOMING FEEDER**.

IF ADEQUATE LOAD PEAK MANAGEMENT ACTION COMMENSURATE WITH THE PREDICTED DEMAND CONTROL OUTPUT AND (NEGATIVE) SPARE LOAD WARNINGS IS NOT TAKEN, THE EM 3460 DM > UL DEMAND CONTROL OUTPUT ACTIVATES. THIS TAKES PLACE AT THE NEXT 15 SECOND DEMAND UPDATE AFTER YOUR DEMAND EXCEEDS YOUR PROGRAMMED UPPER LIMIT.

IF THE DM > UL OUTPUT IS USED FOR AUTOMATIC TRIPPING, THEN IT MUST BE WIRED UP TO TRIP THE ENTIRE LOAD CONNECTED TO YOUR INCOMING FEEDER AND NOT JUST A PARTIAL LOAD. IF YOU DO NOT TRIP YOUR TOTAL LOAD IMMEDIATELY, THE DEMAND WILL CONTINUE TO RISE AND YOU WILL INCUR A DEMAND PENALTY.

CAUTION

IN PLANNING THE CONTROL OUTPUT USAGE, ENSURE THAT THE EM 3460 OUTPUT RELAY RATINGS ARE NOT EXCEEDED. IF THESE WILL DRIVE THE COIL OF AN AUXILIARY CONTROL CONTACTOR, THEN THE SPARK QUENCHERS SUPPLIED WITH YOUR EM 3460 MUST BE CONNECTED IN PARALLEL WITH EACH CONTACTOR COIL. OTHERWISE THE EM 3460 OUTPUT RELAYS WILL GET DAMAGED AND SCHNEIDER ELECTRIC CONZERV'S WARRANTY WILL BE VOID.

2.5.8. Wiring Cross-Check (Phase Angle Analysis)

Three-Phase electrical wiring needs special attention to the correct identification of voltage and current signal phases as well as current signal polarity (S1, S2). Any mix-ups, either during installation or during any re-wiring, will cause wrong readings on your instrumentation and possible damage to rotating machinery.

Wiring mix-ups are difficult to detect because the wrong readings are often close to your expectation.

The EM 3460 has a built-in phase analyzer to show fundamental V1, V2, V3, A1, A2 and A3 vector phase angles. After the Setup (Field Programming) and wiring have been completed, run the EM 3460 and view these phase angle readings for an instant verification of correct signal connections. **Go to [PAR] = V or A** and **press the [v] key repeatedly.** The voltage phase angles are displayed with respect to V1 and the current phase angles are displayed with respect to the corresponding voltage vector.

Make sure that you have loads switched on that add up to at least 10% of the Current full scale and that these loads are resistive. Below 10%, your Plant characteristics could give you misleading readings. For example, Power-Factor correction capacitors often remain in-circuit and could give you highly (mis)leading Current phase angles.

Table 2.5.8.1 below lists the phase angles with correct wiring and Resistive (Unity PF) Loads

	RYB Sequence	RBY Sequence	Remarks
$V1^0$	0^0	0^0	
$V2^0$	120^0	240^0	
$V3^0$	240^0	120^0	
$A1^0$	0^0	0^0	For Unity Power Factor
$A2^0$	0^0	0^0	
$A3^0$	0^0	0^0	

CAUTION

AN INCORRECT PHASE SEQUENCE WILL ROTATE 3 PHASE MOTORS THE WRONG WAY, DAMAGE MACHINERY AND CAUSE SERIOUS INJURY. PHASE SEQUENCE ERROR IS NOT EVIDENT FROM POWER OR ENERGY READINGS (EXCEPT IN THE EXCHANGE OF 2 ELEMENT Wry AND Wby READINGS)

These 3 checks will identify any connection errors:

1. If there is an interchange in the voltage phase connection, then the 120^0 and 240^0 readings will get exchanged. This amounts to a reversal in Phase Sequence.
2. In case of interchange between two current signals, then they will show 120^0, -120^0 or 240^0.
3. If the polarity (S1, S2) of any current signal is reversed, then it will show an additional shift of 180^0.
   In combination with Error 2 above, the affected current phase angle will be

around $+60^0$ or -60^0. The error, often occurring on all three current signals, can be detected with the recommended minimum level of resistive loading. See the example that follows.

Any error in the wiring **must** be corrected now, before proceeding.

NOTE 1: The actual readings may show small variations (say $\pm 5^0$) depending upon the unbalances in the system. Current phase angles will show additional variations depending on the phase-wise power factor.

NOTE 2: If you have programmed your EM 3460 Setup for Delta 3V2A (no A2 current signal), ignore the A2 Phase Angle since it is computed vectorially from A1 and A3 and does not need to be separately corrected.

NOTE 3: The Current Phase Angles are given for Forward Flow of kW (Import by the consumer). For Reverse flow (Export by consumer), the angles will be 180^0 instead of 0^0.

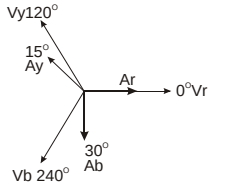
NOTE 4: The EM 3460 Power (kW) reading polarity is Positive for Forward flow (Import by consumer) and Negative for Reverse flow (Export by consumer).

NOTE 5: For integration of Exported Energy, the Import-Export (-IE) Option is required. The EM 3460 Demand Computation locks out Reverse flow (Export by consumer) of Power both with and without the -IE Option. See “Appendix A: Four Quadrant Operation” on page 53 for more information.

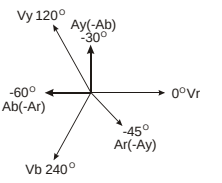
AN EXAMPLE

Two troublesome wiring errors are used to illustrate Phase Angle analysis with your EM 3460.

WITH CORRECT CONNECTIONS:

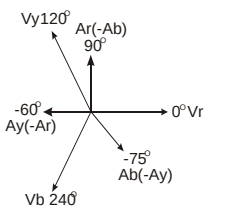
RYB Sequence: $V1^0 = 0^0, V2^0 = 120^0, V3^0 = 240^0$ Current Vectors: $A1^0 = 0^0, A2^0 = 15^0, A3^0 = 30^0$	

ERROR CASE 1:

Case 1: $A1^0 = -45^0$, $A2^0 = -30^0$, $A3^0 = -60^0$ Symptoms: All currents are -30^0 to -60^0. A1 = -A2, A2 = -A3, A3 = -A1 Current Phases interchanged anti-clockwise and S1, S2 Polarities reversed. Correction: A1 = -A3, A2 = -A1, A3 = -A2	

ERROR CASE 2:

Case 2	:	$A1^0 = 90^0$, $A2^0 = 60^0$, $A3^0 = 75^0$
Symptoms	:	All currents are $+60^0$ to $+90^0$ A1 = -A3, A2 = -A1, A3 = -A2 Current Phases interchanged clockwise and S1, S2 Polarities reversed.
Correction	:	A1 = -A2, A2 = -A3, A3 = -A1



2.6. MAINTENANCE

2.6.1. Back-up Circuit Renewal

The EM 3460 data and clock back-up component requires renewal typically after 10 years from the date of the first Full-Setup. If the operating temperature specifications of the EM 3460 have been grossly exceeded, renewal may be required sooner. If the unit displays “Err 66” on power up, please contact SCHNEIDER ELECTRIC CONZERV for back-up circuit renewal. Approximately another four weeks of backup under Auxiliary Supply Failure may be possible, without loss of data.

2.6.2. Cleaning

To clean any grime accumulated on the front panel use a soft cloth dampened (not wet) with soap-water or a mild detergent. Do not exert excessive pressure over the displays.

CAUTION

DO NOT USE ANY SOLVENTS OR ABRASIVES TO CLEAN THE EM 3460.

DANGER

ENSURE THAT THE EM 3460 ESPECIALLY THE TERMINAL AREA IS FREE FROM ANY LIQUID. SEEPAGE OF ANY LIQUID INTO THE EM 3460 WILL RENDER IT UNSAFE FOR USE AND WILL REQUIRE REPAIRS.

DANGER

DO NOT ATTEMPT TO WIPE THE TERMINAL AREA; HAZARDOUS VOLTAGES ARE PRESENT. EXCESSIVE DUST BUILDUP ON THE TERMINAL BLOCK SHOULD BE BRUSHED CLEAN ONLY BY QUALIFIED AND TRAINED PERSONNEL AFTER THE PT, CT AUXILIARY SUPPLY AND EM 3460 CONTROL CIRCUITS HAVE BEEN DE-ENERGIZED. WITH ALL THE CIRCUITS DE-ENERGIZED, PROPER TIGHTNESS OF TERMINAL SCREWS SHOULD ALSO BE CHECKED.

No other maintenance is required for the EM 3460.

2.7. CALIBRATION

The rated accuracy drift of the EM 3460 is 0.1% per year. The user can decide the calibration interval based on his accuracy requirements. Refer to “Appendix C” on page 57 for how to contact SCHNEIDER ELECTRIC CONZERV for re-calibration.

NOTE: Before sending the unit for re-calibration, remember to note down important readings. On receipt of the calibrated unit, repeat the original installation steps starting with Full-setup. Operation will begin with the data cleared.

2.8. FIELD SERVICE

2.8.1. Error correction and the [CLR] Key

The EM 3460 has been designed to ensure reliability. EM 3460 is equipped with several error correction and recovery mechanisms in order to handle severe disturbances. In the rare event that it is unable to recover by itself, it displays an error message such as “Err 151”. In case of an acute error (such as Err 128: Setup Error), the EM 3460 shuts down and the EM 3460 Output Relays are put in the Shed position.

Note down the error number and then press [CLR]. Repeat the same if errors

prevails. Finally, power down the EM 3460 and after 2 minutes, power it up again. In most cases, normal operation will begin. In some cases, where full recovery is not possible, the unit will operate with some loss of data or with reduced accuracy until you can get it serviced.

If the error still persists, carry out the Full-Setup just like you had done prior to first installing the EM 3460. See the Installation Section for details.

CAUTION

IF THE ERROR NUMBER INDICATES DATA LOSS THEN ENSURE, A FRESH START. REPEAT THE FULL-SETUP PROCEDURE ORIGINALLY USED WHEN THE EM 3460 WAS FIRST INSTALLED. IF THE FULL-SETUP MUST BE DELAYED DUE TO YOUR OPERATIONAL NEEDS, THEN REMEMBER TO PERIODICALLY CROSS-CHECK THE EM 3460 READINGS TILL THE FULL-SETUP CAN BE DONE, AS THE DATA LOSS COULD GIVE RISE TO ERRONEOUS READINGS. THE EM 3460 DEMAND CONTROL OUTPUTS SHOULD NOT BE USED IN THIS CASE. IF EVEN THE FULL-SETUP DOES NOT CLEAR THE PROBLEM, CONTACT SCHNEIDER ELECTRIC CONZERV FOR SERVICE. SEE APPENDIX C ON HOW TO CONTACT SCHNEIDER ELECTRIC CONZERV.

Table 2.8.1.1 below gives a brief description of the error messages

Error code	Error description	Action required on display of error code
Err 65		Contact SCHNEIDER ELECTRIC CONZERV for service
Err 66	Data Back-up circuit renewal required	Contact SCHNEIDER ELECTRIC CONZERV for service. Approximately four weeks of normal operation remain before data is lost on Auxiliary Supply failure.
Err 128	Fatal Setup Error	Repeat Full-Setup. System will restart with all data cleared.
Err 131	Calibration out of specification	Press [CLR] key to acknowledge error and continue operation with reduced accuracy of up to ±2%. Contact SCHNEIDER ELECTRIC CONZERV at the earliest for re-calibration.
Err 129 -133	Non-recoverable Integrator Error	[CLR] key acknowledges error and Clears Integrator.

Error code	Error description	Action required on display of error code
Err 134	Non-recoverable Integrator Error	[CLR] key acknowledges error and Clears Old register only.
Err 135	Non-recoverable Profile Error	[CLR] acknowledges error and Clears Profiles.
Err 150	Improper selection of electrical system	Re-enter the Full-Setup Menu and correct the first two Settings (Star / Delta, 4V3A /3V3A).
Err 151-153 and Err 162-165	Sampling Short-cycle error	Contact SCHNEIDER ELECTRIC CONZERV for Service and re-calibration. (This error may occur very rarely under severe disturbance or if operated at temperature extremes. If this occurs very frequently even under proper operating conditions, then loss of data, reduced accuracy and possible damage are indicated).
Err 158,159	Improper Procedure Warning	(This error typically occurs when the calibration procedure is not being correctly followed. May also take place when entry to the Full-Setup Menu is attempted while the unit is still wired to the panel).
Err 166	Suspected hardware problem	If this recurs, contact SCHNEIDER ELECTRIC CONZERV for Service and re-calibration.

2.8.2. Servicing

In the unlikely event that your EM 3460 fails, the unit has to be disconnected and dismounted from the panel and sent to SCHNEIDER ELECTRIC CONZERV for servicing. See “Appendix C” on page 57 to contact SCHNEIDER ELECTRIC CONZERV.

To make this step convenient, the initial installation should include the following points:

1. The EM 3460 mounting should allow easy access to the mounting clamps and terminals blocks.

2. The PT secondary connections and Auxiliary Supply should be easy to de-energise and disconnect. Installing protective fuses, for example, achieves the dual purpose of protection and easy disconnection.
3. A CT shorting block should be installed so that the EM 3460 current inputs can be disconnected without the danger of open-circuiting the CT secondary and tripping the protective relays.
4. If the EM3460 Control Relays are used, then a by-pass switch should be installed.
5. Wiring shall be routed to allow easy disconnection from the EM 3460. The wires should be properly labelled and colour-coded to allow easy re-connection to the serviced EM 3460.

For disconnection and removal, the same DANGERS and CAUTIONS apply as for Installation. Read the Installation section for de-energizing the various circuits connected to the EM 3460.

DANGER

INSTALLATION, DISCONNECTION OR REMOVAL OF THE EM 3460 SHOULD BE CARRIED OUT ONLY BY QUALIFIED, PROPERLY TRAINED PERSONNEL, AFTER PROPERLY DE-ENERGIZING THE CONNECTED CIRCUITS. DURING NORMAL OPERATION OF THIS INSTRUMENT, HAZARDOUS VOLTAGES ARE PRESENT AT THE REAR TERMINALS, WHICH CAN CAUSE SEVERE INJURY OR DEATH. THESE VOLTAGES ARE PRESENT THROUGHOUT THE POTENTIAL TRANSFORMER (PT), CURRENT TRANSFORMER (CT), AUXILIARY SUPPLY AND CONTROL RELAY CIRCUITS.

DANGER

THE COVERS OF THE EM 3460 SHOULD NEVER BE DISMANTLED OR OPENED. THERE ARE NO USER-SERVICEABLE PARTS INSIDE. THE EM 3460 CONTAINS HIGH-PRECISION COMPONENTS WHICH REQUIRE SPECIAL HANDLING AVAILABLE ONLY AT AUTHORIZED SCHNEIDER ELECTRIC CONZERV SERVICE LOCATIONS. HIGH VOLTAGES ARE LIKELY TO BE PRESENT INSIDE EVEN AFTER THE EM 3460 HAS BEEN SWITCHED OFF. OPENING THE COVERS OF THE EM 3460 AND/OR ANY ATTEMPTS TO DISMANTLE, SERVICE, REPAIR OR MODIFY THE UNIT BY UN-AUTHORIZED PERSONS MAY CAUSE SEVERE INJURY, DAMAGE THE UNIT AND ALSO RENDER SCHNEIDER ELECTRIC CONZERV'S WARRANTY VOID.

3. OPERATION

3.1. INTRODUCTION

This Chapter covers the following:

a) Programming the EM 3460, and the Password system
b) Viewing the different EM 3460 readings
c) How to clear (reset) the Integrator and Profiler

Several settings of the EM 3460 can be field programmed by the user prior to installation, through the Full-Setup Menu. Others can be set periodically, during operation, through a Partial-Setup. A valid password code is required for entering the Setup Menu and for clearing the Integrator and the Profiles.

3.2. PASSWORD CODES

All actions of the [SET] and [CLR] keys are guarded by Password Codes for security. The [SET] key is used for Setup (field programming) and the [CLR] key used for Clearing (resetting) the Integrator, the HiLo Profile, or the Demand Profile in case of EM 3460.

There are four passwords: 1xxx, 2xxx, 3xxx and 4xxx. The “xxx” in each password is an independent number from “000” to “999” and can be periodically changed by its authorized user.

1xxx is normally allocated to the Supervisor and has maximum access. See Table 3.2.1 below. The Supervisor assigns the 2xxx, 3xxx and 4xxx codes to each Shift In-charge. The Supervisor can also re-assign and change any of these 3 codes, even if he does not know the full code. Each Shift In-charge may then periodically change his own code (the “xxx” portion).

NOTE 1: If you value convenience more than security, leave the Codes to the Factory defaults of 2000, 3000 and 4000. But change the 1000 code before someone re-programs the codes, or you could get locked out permanently.

NOTE 2: If you do not enter the correct code while entering Setup (Full or Partial) described below, you may view the settings, but you cannot change them (No Set).

CAUTION

WHEN CHANGING CODES, REMEMBER TO NOTE THE NEW CODE IN A SAFE PLACE. IF YOU FORGET YOUR CODE, THE SUPERVISOR CAN GIVE YOU A NEW ONE. IF THE SUPERVISOR FORGETS AND CANNOT ENTER HIS CORRECT 1xxx CODE, THEN CODE RE-ASSIGNMENTS CAN NO LONGER BE DONE. TO MAKE THE UNIT OPERATIONAL AGAIN, THE EM 3460 MUST BE DISCONNECTED AND SENT TO SCHNEIDER ELECTRIC CONZERV. SCHNEIDER ELECTRIC CONZERV MUST ERASE THE EM 3460 COMPLETELY AND RE-PROGRAMME IT. THE UNIT WILL BE RETURNED COMPLETELY RESET WITH FACTORY SETTINGS. ALL DATA WILL BE LOST. THIS SERVICE CHARGE IS NOT COVERED BY THE WARRANTY AND NECESSARILY INCLUDES RE-CALIBRATION SINCE CAL DATA ALSO GETS AFFECTED.

Table 3.2.1: Code Access Levels

	CODE			
	1xxx	**2xxx**	**3xxx**	**4xxx**
Full Setup	Y	Y	-	-
Partial Setup	Y	Y	Y	Y
PF Lock, L0, Step,Hrs	Y	Y	-	-
SetCode (Own Code)	Y	Y	Y	Y
SetCode (All Codes)	Y	Y	-	-
CLR (INTEG, Profile)	Y	Y	-	-

3.3.OPERATING EM 3460: KEYS

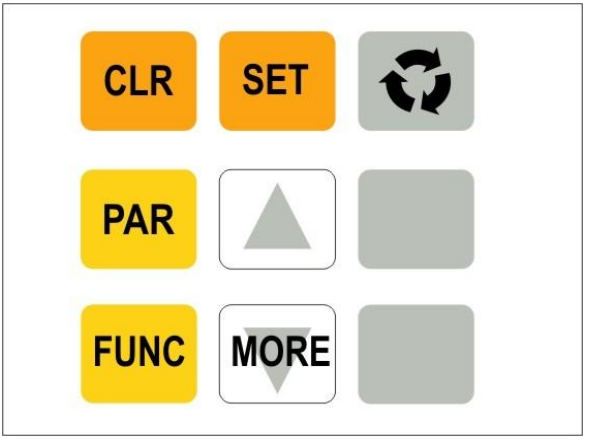


Fig 3.3.1 above shows the front panel of EM 3460 with the seven smart keys.

Table 3.3.1 below describes the functions of the seven smart keys available on EM 3460 front panel

Key	Meaning	Function of the key	Remarks
CLR	Clear	To clear integrated parameter, profile and Demand (DM), Error codes	Press CLR key, the instrument will display the parameter. The blinking parameter will get cleared. The CLR function is protected by password.
SET	Enter	To store or validate the settings done	Pressing the SET key will store the setting done
PAR	Parameter	To view the parameter	Eg: VA, W, A, F, Hrs, Integ & Old are coded yellow
▲	UP	To scroll upward / to view previous parameter / to decrement the edit (blinking) value	
FUNC	Function	To select INTEG, OLD, PROFILE, THD or RMS (all FUNC LEDs OFF)	INTEG = Integrated parameter, coded yellow. OLD = (Cleared Integ data), coded yellow PROFILE = High (Hi)/ Low (Lo) profile of parameters THD = Total Harmonic distortion of voltage and current

MORE	More details / Down	To scroll downward / to increment the edit (blinking) value	Pressing MORE key for parameter will give further/ phase wise details of the parameters Eg: You may view the phase wise Watts by pressing MORE key with below setting. Function: RMS Parameter: W Similarly, further/ phase wise details for other parameters can also be viewed

3.3.1 Auto Scroll

The Auto Scroll key above displays only the parameters selected by the user sequentially for 5 seconds each.

1.) To delete Parameters from the Auto-Scroll List:

Set the EM 3460 to the Auto-Scroll mode.

Wait for the un-desired Parameter to be displayed through Auto-Scrolling. Immediately press CLR key. The Parameter will be removed from the Auto-Scroll List after displaying its serial number.

The EM 3460 exits Auto-Scroll mode and enters into user mode (this is done in order to enable the users to easily insert any other Parameter in place of the removed parameter).

NOTE: With the v4 EM 3460, press the CLR and Auto-Scroll keys simultaneously to delete a parameter from the Auto Scroll list. With Integ / Profile Parameters this is critical; if the CLR key is pressed first, the EM 3460 goes to Integ / Profile Clear mode**.**

2.) Meaning of display messages related to Auto Scroll:

NULL "NULL" is displayed if the Auto Scroll key is pressed before any parameters have been programmed in the Auto Scroll list.

NULL	“NULL” is displayed if the Auto Scroll key is pressed before any parameters have been programmed in the Auto Scroll list.
FULL	“FULL” is displayed if an attempt to programme more than 16 parameters into the Auto Scroll list is made.
AUTO	If the Auto Scroll key is pressed continuously when the unit is in User mode, "AUTO" will be displayed. This indicates that the unit has entered the Auto Scroll mode.
USER	If UP/MORE key is pressed when the unit is in Auto mode it comes out of Auto scroll mode, displays "User" and enters User mode

3.) Getting the best out of the Auto-Scroll feature:

Programme the parameters, which are frequently monitored like kW, kWh, VLL, A.

Programme the parameters in the sequence you wish to see them displayed.

Programme the same parameter more than once to view it for a longer duration.

Repeated later in the list to view it again.

Auto-scroll from one parameter to the next is once every 5 seconds, as in v4. However, in v5, the values will update every 01 second as already stated.

3.4. SETUP (FIELD PROGRAMMING)

3.4.1. Entering Setup

To enter set up mode, press the SET and Up Arrow keys [SET] + [^] together. You will enter the setup menu at one of the three levels explained below. In all three cases, the Full-Setup Menu may be viewed. But changes to settings may be restricted according to your access level and other conditions as described below. For a flawless setup, always scroll through all the choices available for each setting. This also improves the EM 3460’s error checking of your settings.

3.4.2. Full – Setup

This is typically done once prior to installing the EM 3460 with only the auxiliary Supply connected. **The unit must have no signals connected.**

Follow the steps below to enter and programme full set up:

These safeguards prevent accidental or deliberate meddling with critical Settings such as:

Star (4 wire) or Delta (3 wire),

2 or 3 Element (Wattmeter) Measurements,

Demand Parameter: VA or W (EM 3460),

Volts Primary and Amps Primary setting, etc.

Follow the steps below to enter and programme full set up:

Table 3.4.2.1 Full set up entry and programming

	Action	Display	Remarks
1.	While pressing the [SET] and [^] keys together, energize the Auxiliary Supply. Continue to keep the key pressed till “Test” is displayed	“Test” “Code y”	The EM 3460 has entered the setup sequence. Valid code entry is required. Set “y”
2.	Validating / accepting the code (factory set / default code is 1000) Press [SET] to select “y” (Yes).	“1000”	The Cursor is indicated by the blinking digit.
3.0	Validating / accepting the code number Press [SET [to enter each digit, four times in all.	“Success”	This enters 1000 (the default), as the code, If you have changed the code, you must use the [v] or [^] keys to change the digit before pressing [set]. On display of “Success” proceed to step 3.1. If the code is wrong, the display will show “Fail” instead of “Success”. Switch off the Auxiliary Supply and try again from Step 1.
3.1	Press [SET] key to accept “y”	“Clr y”	Yes. Clears Integ, Old, Profile (DM HiLo) and DM readings.
4.	EM 3460 shows entry into Full setup	“Full Set”	In case input signals are present, “Err 158” will be displayed. Disconnect all wiring (except auxiliary supply). Instead if the Code failed, the display will show “No. Set”. For both, go back to Step 1
5.	Press the [SET] key to change the Star 3E setting.	“Star.3E” Blinking	Your system type should be selected. For setting see Table 3.4.3.1and 3.4.4.1 below. Caution: Wrong settings will lead to wrong readings
5.1	Press the [v] to change to Delta 2E.	“Delta.2E” Blinks	This is the example to illustrate programming

	Action	Display	Remarks
5.2	Press the [SET] key to accept the selection.	“Delta.2E” Steady	
6.	Press the [v] key to scroll down and [SET] to change other settings. Use [^] to scroll up. See tables 3.4.3.1 and 3.4.4.1 below		This example changed tar 3E setting to Delta 2E. Use the same [SET] procedure for other settings.
7.	Now scroll [v] down to the end.	“Done y” “y” Blinks	If you accidentally press MORE or [v] key the instrument displays “Done n”. Pressing [SET] key now will ignore the changes /settings you have done. In such case repeat from step 1.
8.	Press the [SET] key to accept “y” (Yes, Done).	“ Store Y” “y” Blinks	The changes / settings done by you is saved now.
9.	Press the [SET] key to accept “y” (Yes, Store).	“Stored”	Save and exit setup. The last changes are effective.
10.	The EM 3460 exits set up mode and enter the run mode by displaying Volts 0.000V	“0.000”	RMS V LL Parameter. Use [FUNC], [PAR] and [MORE] to view all the other parameters.

These settings can never change while the unit is operating. They comprise the first part of the Full-Setup Menu. Under Partial-Setup described below, these settings may be viewed, but cannot be changed.

3.4.3. To do a Partial-Setup:

While instrument is in operation, this procedure is used to make periodic on-line adjustments. However, before using a new instrument, the Full Setup above MUST be done.

Table 3.4.3.1 below describes partial set up

	Action	**Display**	**Remarks**
1	Press the [FUNC] key till no FUNC LED is lit (RMS mode). Press [PAR] key to display “Hrs” or any other parameter available in partial setup (UL, LL etc). Now the unit is now ready to enter Setup.	E.g Hrs	You must start in RMS Mode. This means ALL FUNC LEDs (INTEG, OLD, PROFILE, THD) are OFF.
2	Press the [SET] and [^] keys simultaneously till “setup” is displayed. EM 3460 maybe running (Vin and A signals may be present).	“PAR SET” “Code y”	Set y (Yes). Valid code entry required.
3	Follow steps 2 & 3.0 of Table 3.4.2.1 above		EM 3460 displays “par set” and enters the Hrs setting of Partial Setup. No need to Clear Integrators. Editing of the settings remains the same as Table 3.4.2.1
4	“Store y”, [SET]	Eg. Hrs	Save and exit setup. Return to the Run mode parameter

NOTE 1: When scrolling backwards, remember that Setup Menu settings placed prior to the Partial-Setup list, belong to the Full-Setup. They may be viewed, but can be changed only through the Full-Setup procedure described.

NOTE 2: Changes do not come into effect until you come to the end of the Setup Menu and select “y” (Yes) for both “Done” and “Store”. Selecting “n” (No) for “Store” ignores the changes you have made in the latest Partial-Setup session.

CAUTION

WHILE YOU ARE IN THE PARTIAL-SETUP MENU, THE EM 3460 WILL CONTINUE MEASUREMENTS AND EM 3460 CONTROL. HOWEVER, YOU ARE ADVISED NOT TO ENTER SETUP OR REMAIN WITHIN THE PARTIAL-SETUP MENU UNNECESSARILY, AS IT WOULD INCREASE THE CHANCES OF ERRORS PARTICULARLY FROM IN-ADVERTENT KEY OPERATIONS. DO NOT ATTEMPT SETUP AT CRITICAL PROCESSING POINTS SUCH AS MIDNIGHT**.**

3.4.4. View Setup (No Set)

If you have not entered the correct Code, then the EM 3460 will display “No.Set” to indicate that you may only view the Setup parameters, but no Settings can be changed. This can also happen if you use the [^] or [v] keys to select “n” in response to the “Code Y” query by the EM 3460 on entering Setup, and is a convenient way of just checking some settings when you don’t want to enter the Code, or don’t know it.

Table 3.4.4.1 - Setup Menu Full-Setup and Partial setup

Factory settings are shown in **bold** text. “Y” = applicable for the Model, “-” = not applicable

Parameters	Settings	EM 3460 IE
Time. 24Hr format. The internal clock of the EM 3460 is initialized at the time of installation, via the Full-Setup. The Hours and Minutes can be scrolled to the correct value with the [^] or [v] keys and [SET]. The seconds value may be zeroed with either the [^] or the [v] keys and [SET]. Once set, the EM 3460’s clock will maintain the correct time even through power failures. The Partial-Setup only allows small corrections (± 5 minutes) to the system’s clock.	12.00.00 00.00.00 to 23.59.59	Y

Parameters	Settings	EM 3460 IE
Start %. Sets the "starting current" of the EM 3460. If set very low i.e. Below 0.15% (of full scale), then "creep" condition is introduced. As a result, the integrator continuously runs with smallest pick-up values when there is no load, or from auxiliary fans, pumps or other loads, when the main load is off. In addition, the EM 3460 "START" setting allows the setting of Starting Current, kW or kVA, as shown by the LED in Full / Partial setup.	**0.15% of A** 0 to 99.9% Full scale of the A,VA,W	Y
Power Factor Lock. Controls the Integrator and EM 3460 0, 1, 2, 3 Demand operation during Leading Power Factor. For non-tariff related applications, use the default level of 0	**0** 0,1,2,3	Y
Port Set Sets the communication parameters – Baud Rate (300 to 19,200 Band), Parity (Odd, Even, No, Forced – 9 bit mde), Stop Bits (1. with No Parity, 2. Stop Bits also available).	**9600.E.1** 300 - 19200,O,E,N	Y
ID Identification sets the Unit ID (Address) of the EM 3460 instrument. Each instrument which is connected to the same communication Port of the eLAN PC should have a different (unique) Unit ID. The instruments respond only to those commands matching its own Unit.	**001** 1 to 247	Y
SetCode This allows the authorized User to change his own code. The old code needs to be set correctly, followed by the new code.If your code is 1xxx, then after entering your old code,your new code may be 1xxx, 2xxx, 3xxx or 4xxx code. This allows you to change and re-assign the other User's codes without knowing them.	**000** 1000-4999 Old xxx New xxx	Y

Parameters	Settings	EM 3460 IE
UL (Main UL). Demand Control Upper Limit. EM 3460 Demand Control Upper Limit. If your load peaks are more than twice UL, then the Demand Control Trip Point will be slightly above UL due to the 15 Second Demand Control cycle. UL should be set around 90% of contract Demand to start with (For 1500 kVA Contract Demand, set to say 1300 kVA). The UL setting is used only for Demand Profile generation.	**1100k** 1% to 100% of Full Scale	Y
LL (Main LL). Demand Control Lower Limit EM 3460 Demand Control Lower Limit. LL Should be set roughly to 90% of UL. (Say 1100kVA.) This This determines the point for restoration of loads. NOTE: The closer LL is to UL, the more frequent will be the load shedding cycles, but the loads shed are likely to be smaller. This suits plants comprising several small loads. If on the other hand you have a few large loads, increase the spacing of LL below UL suitably.	**1000k** 10% to 99% of UL	Y
DM control TOU settings (tou.UL.LL) these settings can be accessed only if the tou table is programmed. If not, it goes to next setup parameter. Press Set key to d.ctrL "y" (blink display) allows the user to configure 16 sets of UL and LL and gives the permission to allow next setup parameter (U.L.Sl.Cfg). DM control TOU UL and LL boundary limits (min. and max.) are as same as as Main UL and Main LL. This DM control UL and LL will be activated as per TOU U.L.Sl.Cfg (next setup parameter) configuration. If DM control TOU is not there, EM 3460 will activate Main UL and LL	U1. 1100k, L1. 1000K . . .up to . . . .U16 U1 to U16 1% to 100% of full scale L1 to L16 10% to 100% of UL.	Y

Parameters	Settings	EM 3460 IE
Mapping of DM control TOU limits in to TOU zones(U.L.Sl.Cfg) : Sx.Yy.Zz Where S – season, x – Season Number. Y.Slot name (E – Week End, D – Week Day, H – holiday), y – slot number Zz – nth set of DM control UL and LL (For Not available 0 should be programmed. Max. up to 16. Numerical value 1 will index UL1 and LL1 programmed. 2 means UL2 and LL2, 3 gives UL3 and LL3 etc.	S1. E1. 01 . . . . . up to . . . . .S1. H8. 00 (default 0 – No TOU UL and LL selected) e.g., S1. D1. 03 configurations activate U3 and L3 for the first week day slot of Season1.	Y
EsLD Essential Load. EM 3460 Essential Load. The EM 3460 allows for critical loads like Numerically Controlled Machines, which cannot be included in the load shedding exercise. The Demand Control algorithm ensures that this Essential Load will be allowed to run with minimum interference, (say 150 kVA). Typically, EsLD should be below 10% of UL. Programming too high a value will unnecessarily advance the load Shed action to protect the large Essential Load.	**0** 0 to 99% of LL	Y
PdIN (Prediction Interval) Interval. The 3460 Demand Control algorithm is smart enough to constantly predict your demand. Naturally, the Prediction interval is valid for any period with in 1 to 30 of minute Demand Period; PdIN is programmable from ¼th to ½ of the Demand period. If your load variation is a very large (load peak more than twice UL), the smaller PdIN setting should be used for smoother control.	**7 min** ¼th to ½ of d.Prd	Y

Parameters	Settings	EM 3460 IE
L0. Level 0. EM 3460 Demand Profile mid band with levels L1 to L9 above and L - 1 to L - 9 below, separated by the step size.	**880k** 10% to 100% of Full Scale	Y
StepEM 3460 Demand Profile step size. Sets the spacing of the Profile levels.	**40k** 1% to 5% of Level 0	Y
Poles. Sets the no. of poles of the supply Generator to measure its Speed in rpm.	2,**4**,6,8	Y
VA mode Selection Sets 3d or Arithmetic VA Please refer NOTE.	**VA "3d"**	**Y**
Done. Pressing [SET] to enter "y" (Yes) exits Setup. Pressing the [^] or [v] keys followed by [SET],changes the answer to "n"(No),and the unit re-enters the start of the Setup Menu.	"**y**" **/** "n"	Y
Store. Pressing [SET] to enter "y" (Yes) stores the changes made in the latest Setup session. Pressing the [^] or [v] keys followed by [SET], changes the answer to "n" (No), and exits Setup without storing the changes.	"**y"/** "n"	Y

The v5 EM 3460 displays the ON time and OFF time of the Feeder. The earlier versions used to display the ON time and OFF time of the Load.

NOTE: Power interruptions remain the same in v4 (based on the number of interruptions of feeder).

3.5. INTEG, OLD, PROFILE:

3.5.1. INTEG:

NOTE 1: Energy parameters (kVAh, kWh, kVARh) and PFavg show the Forward flow of energy (Import by consumer). With the Import-Export (-IE) option, you may also see the reverse flow values. See "Appendix A Four Quadrant Operation" on page 53 for more information.

NOTE 2: You may clear the Integrator at any convenient interval. Typically, it would be cleared at the end of each month, to coincide with the electricity bill. This way, the OLD register will contain the last month's records which can be compared with the bill, while the integrator begins

the recording of this month's data. For energy studies, you may for example, choose to Clear the Integrator weekly, if the week's totals are important. You could later add these to arrive at the monthly totals. HINT: Use the [FUNC] and [^] keys to quickly compare between the INTEG and OLD values of the displayed parameters.

NOTE 3: After Clearing, the Integrator must be allowed to run for at least 5 minutes for the recorded values to be accurate.

NOTE 4: The values recorded by the Integrator start with zero when it is cleared, and keep accumulating till the Integrator is cleared again, either by the user through the [CLR] Key, or automatically when the Integrator fills up. If the EM 3460 is operating continuously with Absolute Maximum signals (600v and 7.5A or 1.5A outputs), then the Integrator will fill up and automatically clear itself at the end of 3 months. For signals which are lower, the Integrator can run longer, for upto 9999 Hours (Power On + Power Off) maximum. For the most meaningful results, it is recommended that the Integrator be Cleared through the [CLR] Key to coincide with an important event such as billing, at least once every three months.

NOTE 5: The Integrator continues to run as long as the Signals are present and the Auxiliary Supply is ON. If the Auxiliary Supply comes from a source different from the Signal being monitored, then the Signal may be "live" while the Auxiliary Supply has failed. In this case, no readings will get recorded. In case the Auxiliary Supply is powered by an Uninterruptable Supply (UPS), the Load Run Hrs and OFF Hrs will still be recorded correctly, since Load shutdown is determined via the failure of the voltage and current signals.

CAUTION

IT IS RECOMMENED THAT THE AUXILIARY SUPPLY FOR THE EM 3460 BE DERIVED FROM ITS VOLTAGE SIGNALS, SO THAT THEY FAIL TOGETHER. THIS WILL PREVENT STOPPAGE OF READINGS WHEN ONLY THE AUXILIARY SUPPLY HAS FAILED.

3.5.2. OLD:

NOTE 1: For energy studies, Clear the Integrator at the end of each Observation, so that the values are transferred to the OLD Register and held frozen, while the Integrator begins accumulating data for the next Observation. Note that the next time the Integrator is cleared; the OLD values will be over-written.

NOTE 2: Use the [FUNC] and [^] Keys to quickly compare the INTEG and OLD values of the displayed parameter.

3.5.3. PROFILE:

Perhaps the most powerful of the EM 3460's functions. It actually contains two separate profiles:

a) The HiLo profile, and

b) The EM 3460 Demand Profile for the DM (Demand) Parameter.

The HiLo profile records the H1 (Highest), H2, H3, H4, L4, L3, L2 and L1 (Lowest) values, with date and time of occurrence, for: MaxDM (EM 3460), VA, W, VAR, PF, V, A and F. Saves you having to link to a dedicated computer and carry out additional processing each time.

NOTE 1: For the HiLo profile, the trend of the 1 second RMS value of the appropriate parameter is examined for Maximum (peaks) and Minima's (troughs). Lead/Lag and Import/Export polarity is ignored, even if you have not ordered the -IE Option. This allows you to make easy magnitude comparisons. For the F profile, the frequency averaged over 20 cycles is used. When the values are high, it is possible that there will be Minima's recorded when the values were low. It is therefore possible for say an H4 reading to be lower than the L4 reading.

NOTE 2: The Cleared Profile starts with all 0's. H1 and L1 are the first to receive entries. The other values continue to get recorded as and when the trend shows Maximas and Minima's. H2 and H4 and L4 to L2 show 0 till sufficient Highs and Lows have been detected. A minimum of 1 Hour is required for all the H's and L's of the Profiler to receive entries. Furthermore, the EM 3460 forces a minimum gap of 15 minutes between any two H's or L's of the same parameter, to prevent noise from suddenly filling up the Profile.

NOTE 3: Since the internal resolution of the Profiler is greater than that of the display, two H events or two L events may appear when the values are steady. With two exactly equal events however, the later event replaces the earlier one.

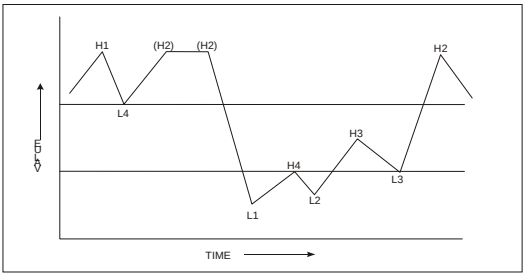


Fig. 3.5.3.1 - The HiLo Profile

The EM 3460 Demand Profile provides a Cumulative Frequency Histogram of Demand values. The profile generates 9 levels above and 9levels below the programmed Level 0 and at the spacing programmed by the Step size in the Setup Menu. Every demand interval (choices 1 minute to 30 minutes), the highest Demand value in the interval is compared with the 19 Levels and a count maintained against each Level that the Demand value has exceeded. The total count of Demands thus compared is also maintained.

Table 3.5.3.1 - EM 3460 DEMAND PROFILE

LEVEL	DEMAND kVA	CUMULATIVE COUNTS
L9	1750	0
L8	1700	0
:	:	:
L3	1450	0
L2	1400	3
L1	1350	16
L0	1300	35
L-1	1250	39
L-2	1200	73
L-3	1150	127
:	:	:
L-8	900	1352
L-9	850	1379
	Total	1440

Suppose the present Upper Limit (Demand Control Upper Limit) equals L0 and is 1300kVA. This sample Demand Profile shows that 35 Demands have crossed the Upper Limit, causing almost as many loads shedding in this month. (1440) Total Demands gives approximately 1 month with 30 min Demand Period. The Upper Limit value of 1300 kVA probably is unrealistically low and may be causing excessive production losses and rejects due to frequent load shedding. If additional Demand can be contracted and the Upper Limit raised, then increasingly merely to 1350 kVA could make a dramatic improvement.

Moreover, the time of these top 3 Demand peaks can easily be pin-pointed via the HiLo for MaxDM, providing a parallel input Load Scheduling and Demand Optimization as well.

The Demand Profile provides valuable post-facto analysis for setting Demand Control Levels towards Demand Optimization rather than merely demand control. It allows immediate visualization rather than mere demand control. It allows immediate visualization of the load-shedding effect of selecting different Demand Upper Limit values. The profile is not just theoretical numbers, since it is data gathered at your plant, for your process patterns. All this, while you safely operate without risk, at your pre-selected Upper Limit.

The HiLo and Demand Profile Start Dates and Times are also provided. Use the [CLR] key to separately reset the HiLo and Demand Profiles.

d) **THD:** Total Harmonic Distortion for Phase-wise Voltage V1, V2, V3 and Current A1, A2 and A3 wave forms.

$$THD = \frac{\sqrt{V_2^2 + V_3^2 + \ldots + V_{30}^2}}{V_f} \times 100$$

Where V_f is the Fundamental and V_2 to V_{30} are 2nd to 30th Harmonics.

The next press of the Func key de-activates all the Functions (FUNC OFF), to give you Present Data. All Func LEDs go off and the PAR key displays all the Instantaneous parameters (colour coded white).

3.6. PARAMETER LIST

Table 3.6.1.1 below lists all the parameters displayed by the [PAR] key. Functions are selectable by pressing the [FUNC] key. Additional Sub - parameters (phase-wise values, etc.) are displayed by pressing the [MORE] key.

3.6.1. Parameters and sub parameters

Use [PAR] key to select the parameter and then [MORE] key to view the desired sub-parameter.

The v5 EM 3460 displays the ON time and OFF time of the Feeder. The earlier versions used to display the ON time and OFF time of the Load.

NOTE: Power interruptions remain the same in v4 (based on the number of interruptions of feeder).

Table 3.6.1.1

Parameters			Sub parameters [v]	EM 3460 IE	EM 3460
[FUNC]		[PAR]			
RMS (All FUNC LEDs are OFF)	Basic	V	Vavg, ry, yb, br, Ln, r,y,b,n,r^0,y^0, b^0	Y	
		A	Aavg, r,y,b,n, r^0, y^0, b^0	Y	
		F	F, Generator RPM	Y	
		Hrs	Dy.dt.mth, Hr:min:sec	Y	
			ON time,Dy.dt.mth, Hr:min:sec	Y	
			OFF time,Dy.dt.mth, Hr:min:sec ,In XXXX	Y	
			Intr (No. of power interruptions) in XXX	Y	

	Power	VA	VA, r, y, b	Y
		W	W, r, y, b	Y
		VAR	VAR, r, y, b	Y
		PF	PF, r, y, b	Y
RMS (All FUNC LEDs are OFF)	Demand	UL		Y
		LL		Y
		EsLD		Y
		PdIN		Y
		MaxDM	Max DM	Y
		DM (Auto) DM (rtc) DM (User)	DM (Auto Sync mode) DM, rd, tr (Rising DM, time remaining) DM, rd, tr	Y Y Y
		PdDM		Y
		SprLD		Y

Parameter			Sub parameters [v]	EM 3460 IE	EM 3460
[FUNC]		[PAR]			
Integ & Old	Basic	V	Vavg	Y	Y
		A	Ah	Y	Y
		F (Freq)	Favg	Y	Y
		Hrs	Since Dy.dt.mth, Hr:min:sec, Run Hrs r XXXX.XX, Off Hrs r XXXX.XX, Intr in XXX	Y Y Y Y	Y Y Y Y
	Energy	VA	(fwd) VAh, (rev) VAh, (total) VAh	Y	-
			VAh	-	Y
		W	(fwd) Wh, (rev) Wh,	Y	-
			Wh	-	Y
		VAR	(fwd) VARh, (rev) VARh, (netl) VARh	Y	-
			VARh	-	Y
		PF	(fwd) Wh, (rev) Wh, (total) Wh	Y	-

Integ & Qua	Demand		Wh	-	Y
		Max DM	MaxDM, Dy.dt.mth, Hr:min:sec	Y	Y
Profile	Basic	V	H1, Dy.dt.mth, Hr:min:sec, H2....H4 L4, Dy.dt.mth, Hr:min:sec, L3....L1	Y	
		A	H1, Dy.dt.mth, Hr:min:sec, H2....H4 L4, Dy.dt.mth, Hr:min:sec, L3....L1	Y	
		F	H1, Dy.dt.mth, Hr:min:sec, H2....H4 L4, Dy.dt.mth, Hr:min:sec, L3....L1	Y	
Profile	Basic	Hrs	H1, Dy.dt.mth, Hr:min:sec, H2....H4 L4, Dy.dt.mth, Hr:min:sec, L3....L1	Y	
	Power	VA	H1, Dy.dt.mth, Hr:min:sec, H2....H4 L4, Dy.dt.mth, Hr:min:sec, L3....L1	Y	
		W	H1, Dy.dt.mth, Hr:min:sec, H2....H4 L4, Dy.dt.mth, Hr:min:sec, L3....L1	Y	

		VAR	H1, Dy.dt.mth, Hr:min:sec, H2....H4 L4, Dy.dt.mth, Hr:min:sec, L3....L1	Y
Profile	Power	PF	H1, Dy.dt.mth, Hr:min:sec, H2....H4 L4, Dy.dt.mth, Hr:min:sec, L3....L1	Y
	Demand	Max DM	H1, Dy.dt.mth, Hr:min:sec, H2....H4 L4, Dy.dt.mth, Hr:min:sec, L3....L1	Y
		DM	(dprof) **L0** xxxxx **L-1** XXXXX, **L-2**....**L-9**. **L9** XXXXX, **L8**....., **L1** XXXXX, (total) **t**XXX	Y
THD	Only Basic	V	r,y,b	Y
		A	r,y,b	Y

APPENDIX A

FOUR QUADRANT OPERATION

A.1.POLARITIES

The EM 3460 carries out true 4 quadrant measurements of Power parameters (kVA, kW, kVAR, PF). The polarities of these quantities are shown below.

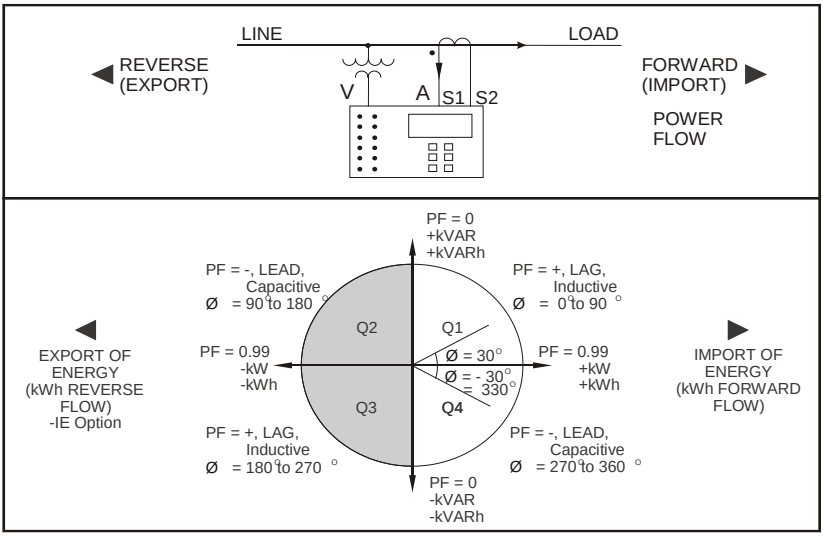


Fig A.1.1 EM 3460 Four Quadrant Polarities

A.2. EM 3460DEMAND

The EM 3460 Demand Computation is locked during Reverse Flow (Export by Consumer) of Power i.e., Demand is computed only for instants of Forward Flow of Power (kW) and is indicative of the Peak Loading by the Consumer, for which billing is done. Reverse Flow (Export) of Power is not integrated. If Power Flow is constantly Reverse (Export by Consumer), then the Demand registered will be zero. This is based on the direction of flow of Real Power (kW) and holds true whether the Demand Parameters is Field Programmed for either kVA or kW. To measure Demand of Exported kVA or kW, see the note following the Import-Export Option below.

A.3. ENERGY PARAMETERS

The EM 3460 distinguishes the direction of power flow (kW) and integrates Energy Parameters kVAh, kWh, kVARh and Avg PF during only the Forward Flow of energy (kWh Import by the Consumer), which accurately reflects the billing. For example Avg PF is the Average Power Factor at which the consumer has imported Energy (kWh).

A.4. IMPORT - EXPORT OPTION FOR ENERGY

If you have ordered the Import-Export (-IE) Option, then Energy Export as well as

Net (kWh, kVARh) and Total (kVAh Avg PF) readings are additionally available. The Power Factor Lock operates as programmed, for the Export direction as well.

NOTE: If you have not ordered the -IE Option, to measure only the Reverse Flow Energy, just reverse all three input polarities (S1,S2). This will also reverse the Forward Flow (Import) and the reverse Flow (Export) polarities of kW, kVAR and PF. For the EM 3460, this is the way to measure Demand for the Exported kW or kVA, whether you have the -IE Option or not.

A.5. POWER FACTOR LOCK

Internationally, capacitive loading is permitted to varying extents in tariff metering. This is done by locking the accumulation of selected Energy Parameters while the Load Power is capacitive. Your EM 3460 is fully equipped to handle such situations.

In the Partial Setup after “start %”, there is a Menu Item called Power Factor Lock . It displays “-PF.Loc.0”, where 0, the default Locking Level, means that no locking is in effect. The Level is changed using the Partial-Setup procedure.

The Locking Level choices are:

0 = No lock.

1 = kVARh is locked.

2 = kVARh and kVAh are locked.

3 = kVARh, kVAH and DM (kVA) are locked. (EM 3460).

If the EM 3460 is not connected with Tariff related measurements, then a Lock Level of 0 is recommended. In Tariff related applications, the local Electricity Supply Authority will provide the current regulations.

With reference to Fig. A.1.1, the effect of locking on each of the above Parameters is:

kVARh : is accumulated only for Quadrant 1 (Q1) and Q3.

KVAh : kVA is clamped to kW (whereas normally kVA > kW) while the system is in Q4 or Q2, for accumulating kVAh.

kVA DM : The Locked kVA as above is used for Demand computation while in Q4. Note that Q2 is not processed here, since Demand computation is already locked for reverse flow (Q2 and Q3) whether D.PAR is kW or kVA. This lock is not meaningful when the D.PAR is kW.

NOTE 1: Locking has no effect on the computation or display of Instantaneous Parameters. It affects only the computation and display of integrated parameters. Q2 and Q3 Energy parameters are available only if the Import -Export (-IE) option has been ordered.

NOTE 2: The PF Lock has been placed in Partial-Setup and given a password authorization level of 1xxx or 2xxx. This has been done so that Locking can be corrected without having to enter Full-Setup and losing data. If the Locking Level is re-programmed, the EM 3460 will recompute kVARh and kVAh correctly according to the new locking level. In the EM 3460, adding or removing Lock Level 3 will take, worst case, 1 to 30 minutes (d.Prd) for Demand to approach its new locked value, and should not be done during critical Demand peaks. MaxDM is not re-

adjusted.

NOTE 3: PF Lock Level 3 is not available, if the D.PAR has been set to kW in EM3460. Entering Full-Setup and changing D.PAR to kW will automatically reset the PF Lock Level to 0 if it had been programmed to 3.

APPENDIX B

WARRANTY

Warranty as per company warranty policy.

APPENDIX - C

HOW TO CONTACT SCHNEIDER ELECTRIC CONZERV

We welcome your feedback, comments and suggestions. Please do visit our Website www.conzerv.com

In the event of any failure, the following steps should be taken

1. Notify SCHNEIDER ELECTRIC CONZERV INDIA PVT. LTD. Giving complete information about the failure and the conditions that existed at that time. Furnish Model Number, Serial Number, Invoice Number and date. On receipt of this information, service or shipping instructions will be forwarded to you.
2. On receipt of shipping instructions, forward the instrument, transportation pre-paid. Repairs will be carried out and the unit will be returned transportation pre-paid. Ensure that the unit is securely packed in its original packing material to avoid transit damage. Transit insurance cover may be arranged at the Consumer's cost.

CONTACT DETAILS:

Schneider Electric Conzerv India Pvt Ltd 44P Electronic City East Phase, Hosur Road Bangalore – 560100 INDIA	Phone:+ 91(80) 3910 2730 Fax : + 91(80) 3910 2735 Help Desk 1800 425 0555 (Toll Free All India from BSNL/MTNL Lines) Or Call +9180 2852 0604 (Standard Charges Apply) email: contact@conzerv.com **Website: www.conzerv.com**

APPENDIX D

TECHNICAL SPECIFICATIONS

Sensing	3 Phases. Field programmable for 3 Wire or 4 Wire	
Measurement	True RMS	
Voltage Input	110v to 440v ac nominal Line-Line (Field Programmable)	
	Crest Factor	850 V peak maximum Line-Line 50 V ac Neutral-Earth 600 V ac Line to Line
	Overload	347 V ac Line to Neutral 347 V ac Line to Earth 347 V ac Neutral to Earth
Surge	2kv 1/50uS Transient, Line – Earth	
	PT Primary	0.1kv to 999 kV ac (Field Programmable)
Current Input	5 A ac nominal (1 A ac Factory Set Ordering Option)	
	Crest Factor	10.6 A (2.12A) peak Maximum without loss of accuracy
	Overload	10A (2A) ac continuous 7.5A (1.5A) ac without loss of accuracy
	Surge	25A (5A) ac 30 Seconds 40A (8A) ac 7 Seconds 100A (20A) ac 1 Second
	CT Primary	(1A to 30,000A)ac (Field Programmable)
Burden on PT	0.2 VA Max per input Signal	
Burden on CT	0.2 VA Max per input Signal	

Accuracy	For all Voltage, Current, Power and Energy Parameters	
	CLASS 1.0	± (0.2% of Full Scale + 0.8% of rdg + 1 Count)
	CLASS 0.5	± (0.1% of Full Scale + 0.4% of rdg + 1 Count)
Accuracy	F : ± 0.2% of reading (Ranges 48 - 52 or 60Hz)	
Digital Readout	7 digit 12.5 mm, 7 segment red LED Automatic placement of decimal point Automatic conversion from Kilo to Mega Units	
Demand Interval	1 to 30 minutes, Field Programmable	
Demand Integration (EM 3460)	Sliding or Fixed Window. Separate Windows for Demand computation and Demand Control. Auto Synchronizing with EB demand interval when using Sliding Window.	
Display Update	Every 15 seconds for Demand. All other parameters, every 1 second.	
Keyboard	Ergonomic sealed Membrane type, wipe clean surface	
Auxiliary Supply	Single phase 50Hz, 240V ac nominal. Working range 190V to 270V. (Factory Set Ordering Option: 110V ac nominal. Range: 85V to 130V) Burden: 5VA Max Approximately.	
Security features	Access to edit the settings through User programmable password.	
Control Outputs (EM 3460)	Potential free changeover contacts. Three separate outputs for the following conditions: (a) Predicted Demand exceeds Upper Limit (b) Demand exceeds Upper Limit (c) Restore Load Contact Rating: 240V/24V dc, 1A Max, with supplied Spark Quencher paralleled with load. Suitable for control contactor Coil rating:	
	Make	60VA Max
	Holding	15VA Max

Dimensions	Bezel 192 x 144mm. Depth behind Bezel 110 mm
Panel cutout	186mm x 138 mm (+1/ -0 mm)
Mounting	With 4 clamps provided
Weight	1800 gms approximately
References	CBIP 88, IEC 1036

NOTE: Due to SCHNEIDER ELECTRIC CONZERV's constant R&D effort, specifications may change without notice.

APPENDIX E

RS 485 COMMUNICATION

E.1.This section is meant to assist experienced Systems Integrators

In hooking up EM 3460s to a PC. If you are not a Systems Integrator, we recommend that you use one; its much more efficient that way. The SCHNEIDER ELECTRIC CONZERV Energy Management Systems group can provide complete Energy Management Networks and related services.

E.2. the Communication between the PC & the EM 3460s is in Master - Slave Mode, where in the PC (Master) sends a command (query) containing the instrument ID & the address of the Information required. The specified EM 3460 then decodes the command and replies with the requested data (usually 50mS to 75mS from End-of-Query to Start-of-Reply).

E.3. The PC recognizes every SCHNEIDER ELECTRIC CONZERV Instrument (EM 3460, Data Concentrator for DM 52 Energy Meters, etc) connected to the RS 485 Network by a unique number between 1 & 247, called Instrument ID. This number uniquely identifies each instrument on the RS 485 Network.

E.4. The Standard Communication Settings are:

4.1 PROTOCOL: MODBUS RTU

4.2 BAUDRATE: 9600. (300 to 19200 baud supported)

4.3 DATA BITS: 8 Bits.

4.4 PARITY: EVEN

4.5 STOP BIT: 1

E.5. The addresses of the Parameters are as follows:

5.1	Amperes	:	3013
5.2	Voltage	:	3009
5.3	kW	:	3003
5.4	Power Factor	:	3007
5.5	kWh	:	3123
5.6	kVARh	:	3125
5.7	Maximum Demand	:	3735

E.6 Identification **of Communication error messages and status in the display of EM 3460 under Frequency parameter.**

Conditions	**Display Messages**
Parity, framing & overrun errors	"o"
Break Error	"b"

Conditions	Display Messages
Tx or Rx Buffer Overflow	"0"
Invalid Unit id	"u"
CRC check error	"c"
Illegal Data Address	"A"
Communication Illegal Function	"F"
Rx	"r"
Tx	"t"

APPENDIX F

F.1 What is the advantage of implementing TOU system?

- Time of use helps the Power utility company optimize the consumption throughout the day and night. Due to higher rates at peak hours and lower rates at off peak hours more and more consumers try to reschedule their processes to off peak hours to reduce the power costs. This will in turn help the utility to reduce the overload at peak hours and to reduce the wastage of power during the off peak hours.

F.2 What are all options of TOU feature available in EM 3460?

- In a year, Max 6 seasons and 10 Public Holidays.
- In a season, up to max. 3 weekends, rest as week days.
- In a day, Max 8 tariff timings and 8 sub Integrators.
- Separate MD registers for different time slots and also separate Demand UL and LL for the different time slots.

F.3 What is an Integrator?

- An Integrator is a register in which all the integrated (energy and time) parameters like Vah, Wh, VARh, Ah, PFavg., Vavg., Favg. Run Hours, Max. DM etc are accumulated or stored.

F.4 How many Integrators are available in EM 3460 with TOU?

- **EM 3460 with TOU feature** has total 9 Integrators. One main Integrator which runs for a day long, where sum of all 8 sub integrators are stored. Up to maximum 8 Sub Integrators which can be configured to store the energy consumption at different time intervals as per the user requirements.
- In addition to this, each time slot can have separate Demand UL and LL. This option is only available in EM3460.

F.5 How to configure TOU setup?

- **TOU** is enabled at factory. TOU tariff timings, Sub Integrator configuration can be done by PCTOU Setup Utility v1.1. Contact your nearest SCHNEIDER ELECTRIC CONZERV representative for details. DM control Limit(UL and LL) configuration can be done by either PC or EM 3460 Front panel keys. Refer EM 3460 QSG to edit the UL and LL through front panel keys.

F.6 When we have to redo the TOU setup? Or when TOU setup will get expired?

- When Electricity Board changes their TOU tariff timings and Tariff.
- When Public Holidays have local holidays like Diwali, Dasara etc.??

F.7 When TOU is active, Should Auto Reset feature clear All 9 INTEG's?

- Yes.

F.8 How to enable and configure the auto reset?

- Auto reset is enabled at factory. Configuration of Date and Time of Auto Reset of INTEG is done by PC TOU Setup Utility v1.1 (Win98).

F.9 When and How the Integrator overflow will happen in EM 3460?

- The EM 3460 accumulates Energy, Run Hours, Outages and other accumulated values in an Integrator labeled as INTEG on the front panel Functions.
- If the Integrator is not manually cleared, it overflows after some months. SCHNEIDER ELECTRIC CONZERV's eLAN PC software reports automatically take this into account, so eLAN users need not worry. Whenever the INTEG is cleared, whether manually or automatically, its contents are transferred to the OLD register for your convenience. However, OLD will contain only one set of values. OLD is not useful once you have eLAN.

F.10 This part explains the interval at which the Integrator will overflow.

- The first point to understand is that the Integrator operates as a Block. Which means that if any one of the various accumulated values overflows, then the entire INTEG Block will be automatically cleared and transferred to OLD. This is done to maintain matched values for accurate eLAN reports as well as for coordinated manual readings.
- Amongst the parameters most likely to overflow, three are significant: F avg (avg frequency), Vavg (voltage avg) and VAh, as they attain the highest values first. The others (Wh, VARh, Ah, Pfavg.) are usually smaller and do not trigger the overflow. This allows for simplification in the understanding of the overflow interval as explained below.
- The following shows the pattern of conditions causing INTEG overflow. As explained earlier, you will notice that the Voltage inputs to the Frequency are significant.

INTEG overflow interval – Number of Days

V secondary LL	**48 Hz**	**50 Hz**	**51 Hz**	**60 Hz**
100 – 120 v	160	155	152	130
400 – 440 v	140	140	140	130

- The last important point is that the overflow under the conditions shown above is controlled mainly by the values of the Voltage signal and Frequency. It is independent of the load. For example, it the feeder were energized and there was no load, then the roll-over values of kWh and kVAh at INTEG overflow will be 0.
- We will close on a brief technical note. For Voltage signals 500 to 600v LL (the Max EM 3460 Vsec input), there **is** a load dependency. If the load runs at max continuously, then the Overflow interval can reduce to 120 days. But this is a rather impractical condition. Therefore, the above table is adequate for all practical purposes. We hope this note was useful in explaining the EM 3460 Integ overflow interval

F.11 How the Customer can get the meters TOU/Auto Reset Configured?

- **This is done by Customer Support. Please Contact nearest SCHNEIDER ELECTRIC CONZERV representative for details.**