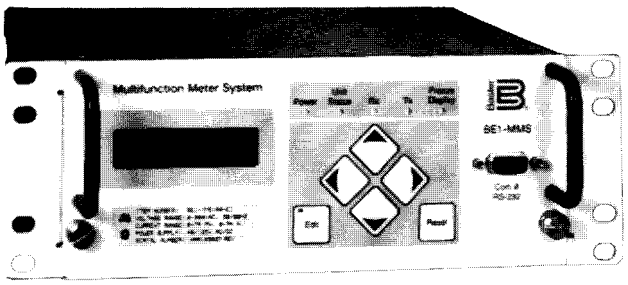


BE1-MMS100 MULTIFUNCTION METERING SYSTEM

The BE1-MMS100 is an economical, microprocessor based, multifunction revenue-accurate power metering system that provides multifunction revenue-accurate power metering, contact status monitoring, and output control functions in an integrated system.

ADVANTAGES

- Provides accurate metering of voltage, current, Watts, VARs, and bi-directional energy measurements.
- Measures individual and total harmonic distortion up to the 31st harmonic.
- Monitors discrete inputs from utility kWh pulse initiators.
- Stores Minimum and Maximum Energy Values.
- Stores 36 days* of 15 minute average data for Volts, Amps, Watts, VARs, Power Factor, frequency and accumulated pulse counts, plus values for imported, exported and total kWh, kVARh, and kVAh, and elapsed time since last reset or it stores 12 oscillographic records* of 21 cycles each at 64 samples per cycle.
- Monitors the status of input contacts from breakers, targets, switches, etc.
- Provides control outputs through built-in interposing relays.
- Available in fully drawout half rack case. Two Basler Electric half rack IEDs (Intelligent Electronic Devices) can be dovetailed together to mount in a standard 19-inch equipment rack with no special mounting hardware.

* History is limited to 18 days or oscillography is limited to 6 events for the DNP 3.0 option.

WINDOWS® SOFTWARE

Interface for setting and communicating with Basler metering products.

Request BESTCOMS for BE1-MMS100.

ADDITIONAL INFORMATION

INSTRUCTION MANUAL
Request publication 9326700991

UMOS® SOFTWARE BULLETIN
Request publication LAB

MODBUS™ INSTRUCTION MANUAL
Request publication 9326700993

DNP INSTRUCTION MANUAL
Request publication 9326700992

Basler Electric
P. O. BOX 269 HIGHLAND, ILLINOIS, U.S.A. 62249 PHONE 618-654-2341 FAX 618-654-2351

FEATURES

METERING

- True RMS measurements of voltage per phase, current per phase, Watts per phase and total, VARs per phase and total, PF, frequency, and phase angle.
- Energy imported, exported, and total kWh, kVARh and kVAh.
- Measures pulses from utility pulse initiators.
- Measures individual and total harmonic distortion on the voltage and current inputs up to the 31st harmonic.

LOGGING AND RECORDING

- Historical data logging of voltage per phase, current per phase, Watts per phase and total, VARs per phase and total, Power Factor, frequency and pulse count every 15 minutes and imported, exported and total kWh, kVARh and kVAh and total elapsed time since last reset for up to 36 days*.
  OR
  Optional oscillographic recording of 12 events*, 12 cycles each at 64 samples per cycle.
- Min/Max logging of voltage per phase, current per phase and total, imported, exported, and total kWh, kVARh and kVAh, and elapsed time since last reset.
- Event logging and alarming with sequence of events time stamped to ±10msec accuracy including configuration changes, set point and min/max events.

* History is limited to 18 days or oscillography is limited to 6 events for the DNP 3.0 option.

CONTROL

- Four non-wetted status inputs and six output relays.

COMMUNICATION PORTS

- Three independent general purpose communication ports.
  - Front RS-232 ASCII and TNP communications
  - Rear RS-232 TNP communications
  - Rear RS-485 Modbus™ or other common protocols
- IRIG time sync (unmodulated)

HARDWARE FEATURES

- Case configuration is H1 (half rack).
- Active CT technology for low burden and increased dynamic range
- Flash Memory for upgrading embedded programming without changing chips.
- Integral HMI with 2x16 character display.
- Wide range ac/dc power supply options provide long holdup time to ride through dips on ac power source. (100ms with four output relays energized, upon complete loss of source. Starting voltage 125Vac for Option 1 (48/125Vac/Vdc) and 250Vac for Option 2 (125/250Vac/Vdc)).

APPLICATIONS

The BE1-MMS100 is ideal for use by utility, industrial, commercial and institutional customers for feeder monitoring and automation, tenant sub-billing, budgetary cost allocation and outage detection. Its unique capabilities make it ideally suited for the following applications:

- Utility sub-metering
- Commercial/Industrial metering
- Substation automation
- Genset applications

And where the following is required:

- A panel meter is needed to read three phase V, I, Watts, VARs, frequency, Watt-hours or VAR-hours.
- Monitoring of energy utilizing a utility meter's pulse contacts.
- Provisions for output contacts capable of replicating metering pulse contacts.
- Metering data logging and the ability to communicate with a central computer running SCADA software.
- Remote or local interrogation/operation of the metering device.
- High sample oscillographic recording.
- Drawout case construction.

UTILITY SUBSTATION AUTOMATION

By using one BE1-MMS100 on each feeder and connecting it to communicate with a central computer running SCADA software such as Basler Electric's UMOS©, the benefit of a complete energy management system can be realized. The BE1-MMS100 provides the system operator with real time analog measurements as well as historical data for planners. The BE1-MMS100 also provides the operator with status inputs and controllable outputs. Together, the BE1-MMS100 and UMOS© interact through the computer screens that form the operators' interface or HMI.

APPLICATIONS, continued

Within this interface reports can be generated and printed for further use. Some of the screens and reports provided by UMOS© are:

SCREENS	REPORTS
Alarm Panel Event Log Sequence of Events Log Strip Charts Forecast Strip Charts Load Control Schedules One-line Diagrams Fault Reports Oscillographic Records Relay Settings	Daily Summary Detail Volts and Amps On/Off Peak Monthly Peaks Fault Relay Settings

METERING POWER CONTRACTS

A BE1-MMS100 can be connected on each power circuit and log metering data for various customers. Using the "call home" and dial-up modes of operation within the BE1-MMS100 and BESTCOMS software, the logged data can be automatically transferred at various intervals.

UTILITY SUB-METERING

The BE1-MMS100 and a Basler Electric BE1 protective relay can be dovetailed together to form a standard 19-inch rack feeder unit for metering, protection and control. The combination provides the advantage of high metering accuracy that is normally unavailable within protective relays due to their wide dynamic range with the protection required for reliable feeder operation.

COMMERCIAL/INDUSTRIAL METERING

The BE1-MMS100 can be applied anywhere a panel meter is needed to measure and record energy consumption or generation. When applied to the incoming feeders of buildings or areas within a facility, accurate data can be obtained for tenant sub-billing or energy consumption costing. When applied to electrical machinery or equipment, the BE1-MMS100 provides measurement of harmonic distortion up to the 31st harmonic.

FUNCTIONAL DESCRIPTION

INPUT SIGNALS

CT/PT Input Signals

The BE1-MMS100 accepts the following input signal combinations:

- 1, 2 or 3 ac voltages supplied from 67 or 120Vac PTs
- 1, 2, 3 or 4 ac currents supplied from 1A or 5A CTs, specified at time of order.

Meter input signals are supplied from PTs and CTs as paired sets of input signals. Input signals are processed in pairs, with the exception of the neutral current input.

The BE1-MMS100 samples the seven input waveforms at the rate of 64 samples per cycle and computes true RMS voltages (3), true RMS currents (4), and uses paired I-V input samples to compute true RMS Watts and VARs.

Voltage inputs are processed as either phase-to-neutral or phase-to-phase. The voltage input configuration is set via the front panel or BESTCOMS.

New data vectors containing voltage, current and the relative phase angle for I-V pairs are available at the communication port once per second. The kW, kVAR and frequency data are also available once per second. The voltage, current, kW, kVAR, Power Factor and frequency information is displayed and updated on the BE1-MMS100 LCD display once per second.

Once per minute the BE1-MMS100 computes the kWh, kVARh and kVAh values and displays the imported, exported and accumulated kWh, kVARh and kVAh on the LCD display. Also, on the minute, the BE1-MMS100 computes the first 31 harmonic values for the voltage or current inputs and the total harmonic distortion (THD%).

Once every 15 minutes the BE1-MMS100 stores in flash memory the phase average of Volts, Amps, kW, kVAR, Power Factor and frequency values. The historical data is stored to flash memory once every 15 minutes or on a power down event. Flash memory will accommodate 36 days of data storage. Data is retained for 36 days and is available for downloading to a master station via the communication port.

Similarly, imported, exported, and accumulated kWh, kVARh and kVAh and elapsed time values are accumulated every minute and kept in RAM, and on a power down event, are transferred to EEPROM.

FUNCTIONAL DESCRIPTION, continued

INPUT SIGNALS, continued

Status and Alarm Input Signals
The BE1-MMS100 accepts the discrete input signal combinations on four channels.

The inputs can be configured as pulsed (MCD) or sustained status inputs on each of the four input channels. The BE1-MMS100 requires a dc contact sense voltage for the contacts and accepts pulses on the discrete input channels (total of four channels available). The BE1-MMS100 stores ten MCD events on each input channel.

Inputs are scanned at 10 millisecond intervals. A debouncing algorithm checks to verify that contacts remain closed for at least three read cycles before "counting" the transition as a valid pulse.

Momentary changes of up to 20 per second are acceptable on each channel, with provision that only the first ten will be stored for each channel.

When a contact transition event occurs, the BE1-MMS100 sets a status bit "on" in the communication port status message. The event will be detected by the substation computer, RTU or master station on the next poll.

For those systems incorporating dial-up communications, the event bit can trigger a "call home" communications session. In this session, the BE1-MMS100 dials a prestored telephone number and establishes a data communications session with the host. During this session, data, including the event that initiated the call, is uploaded from the BE1-MMS100 to the host.

Pulse Input Signals
The four status inputs can be configured as pulse meter inputs. As a Pulse Transducer, the BE1-MMS100 accepts the following input signal combinations: 1, 2, 3 or 4 Form A or B contact inputs from a utility pulse initiator.

Metering output signals (pulses) are supplied as dc inputs from metering KYZ contacts. The BE1-MMS100 uses dc sense voltages on the contacts and accepts pulses on the status input channels (total of four channels available).

Pulse repetition rates of up to 20 per second on each channel are acceptable.

Inputs are scanned at 10 millisecond intervals. A debouncing algorithm checks to verify that contacts remain closed for at least three read cycles before "counting" the transition as a valid pulse.

Once per minute the BE1-MMS100 computes the pulse count on a per channel basis and reports the data via the communication port.

Once every fifteen minutes and on power down, the BE1-MMS100 stores the total pulse count in flash RAM for the 15 minute interval on a per channel basis. Data is retained for 36 days and is available for downloading to a master station via the communication port.

OUTPUT SIGNALS

Discrete Output Signals
The BE1-MMS100 has six Form "A" output contacts for use in control or for pulse inputs. Pulse outputs can be set to represent watts, vars, pulse in 1, pulse in 2, pulse in 3, pulse in 4, or the sum of any of these. The maximum output pulse rate is 30 per minute.

The relays operate on a select and operate basis.

Communications Ports
The BE1-MMS100 has three physical serial ports:
- An RS-232 port on the front of the unit.
- An RS-232 port on the rear of the unit.
- An RS-485 port on the rear of the unit.

The user has a choice of using either the rear RS-232 port for data acquisition and control, or the RS-485 port. The choice is made using the HMI setup procedures.

The BE1-MMS100 supports three data acquisition and control protocol forms (only applicable to the rear ports):

- A Basler TNP data format identical to the ET V4.4 format is used to maintain product compatibility.
- Extended TNP data formats are used for the one-minute and fifteen-minute values.
- Modbus™ data formats.
- DNP 3.0 data formats.

The port supports an 8,N,1 byte format and will connect at the following baud rates: 300, 600, 1200, 2400, 4800, 9600, and 19,200.

DISPLAY FEATURES

The BE1-MMS100 has five (5) indicating LEDs, a keypad and a LCD display.

FUNCTIONAL DESCRIPTION, continued

INDICATORS

Power indicator is the green LED on the left hand side of the indicator group. This is used to indicate operating power applied; the power supply is operational and within specifications.

Unit Status is a red LED next to the green Power LED. This LED flashes once per second when unit is working properly.

Rx is a red LED. This LED flashes when the rear port Rx (receive) signal line is high.

Tx is a red LED. This LED flashes when the rear port Tx (transmit) signal line is high.

Freeze Display indicator is on the right hand side of the indicator group and is used to indicate that the LCD is “frozen”, or locked on present display.

The LED in the EDIT key illuminates when the unit is in program setup mode.

KEYPAD USAGE

There are six pushbuttons: Up arrow, Down arrow, Left arrow, Right arrow, EDIT, and RESET.

The RESET pushbutton is used to set the time interval for 15 minute averages, the elapsed time indicator, and the imported, exported, and accumulated kWh, kVARh and kVAh. The reset function has a prompt to avoid accidental operation.

The EDIT pushbutton is used to set the unit in set up mode. In set up mode the protocol, the delta or wye configuration, the port baud rate, the address, and call home phone number are selected. If password protection is used, the proper password must be entered to operate the EDIT pushbutton.

The arrow pushbuttons are used to set and change the numeric parameters.

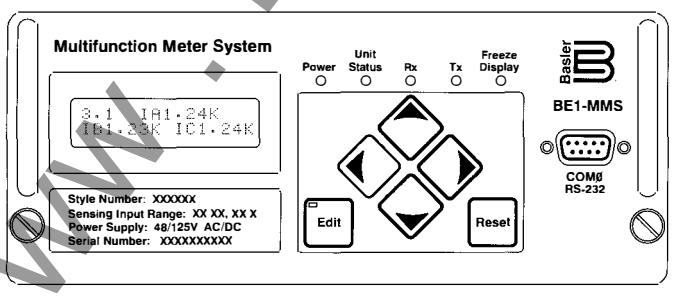


Figure 1 - Front panel of BE1-MMS100

LCD DISPLAY USAGE

The LCD display is a 16 character by two-line display. When the unit is first powered up, the LCD displays “Executing Application”, then switches to the “top level” display, which shows the Model Number and software version.

If no keys are pressed, the LCD switches to metering mode and alternately displays the various parameters measured. This is called scrolling. When the down arrow key is pressed, “Freeze Display” LED lights up and the display locks on the last screen. Press again and the display resumes scrolling, or it will automatically resume scrolling after five minutes. The Metering screens include:

Screen	Parameter	Digits
Metering “a”	kWh	10
	kVARh	10
Metering "b"	Wh Imported	10
Metering "c"	Wh Exported	10
Metering "d"	VARh Imported	10
Metering "e"	VARh Exported	10
Metering "f"	VAh Imported	10
Metering "g"	VAh Exported	10
Metering "h"	VAh Accumulated	10
Metering “i”	kW	10
	kVAR	10
Metering “j”	Volts A	6
	Volts B	6
	Volts C	6
Metering “k”	Amps A	6
	Amps B	6
	Amps C	6
Metering “l”	Amps N	6
Metering “m”	Frequency	3
	PF	3
Metering “n”	THD A	6
	THD B	6
	THD C	6
Metering "o"	Time	8
	Date	10
Metering “p”	Accumulated Time	10

There are three data acquisition and control protocol formats available through the front panel or via the communication ports. These formats are transducer network protocol (TNP, includes oldET), Modbus™, and distributed network protocol DNP. The user makes this choice using the HMI setup procedures.

The communication ports support an 8,N,1 byte format and connect at the following baud rates: 300, 600, 1200, 2400, 4800, 9600, and 19200.

FUNCTIONAL DESCRIPTION, continued

The block diagram below illustrates the hardware functions in the BE1-MMS100.

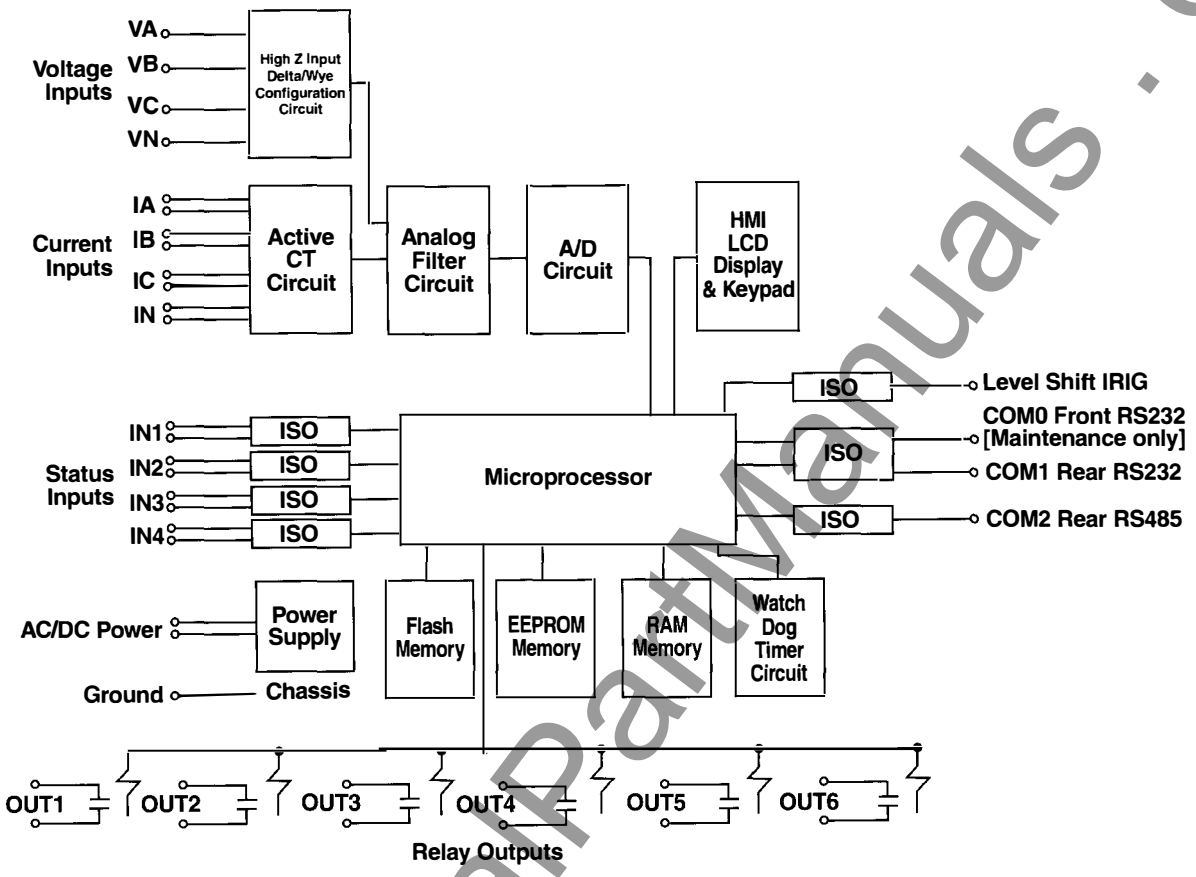


Figure 2 - Block diagram

FUNCTIONAL DESCRIPTION, continued

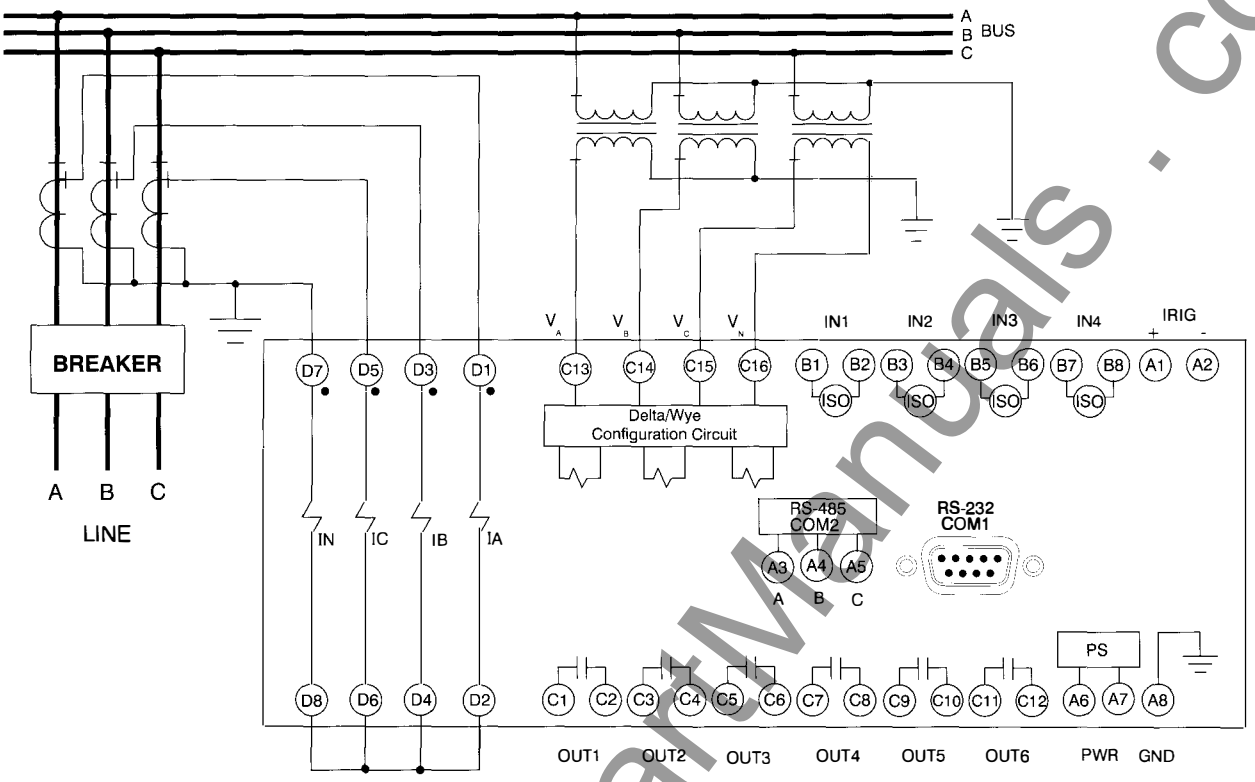


Figure 3 - Typical external connection diagram

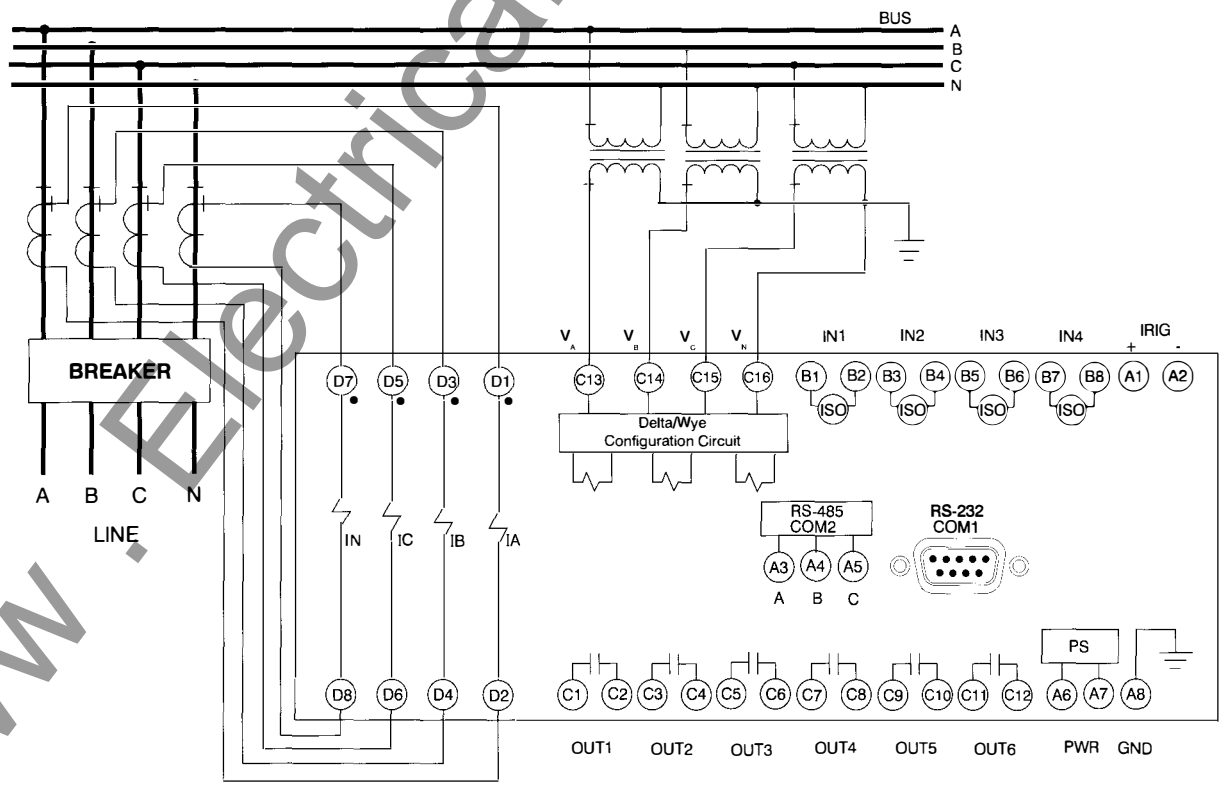


Figure 4 - Alternate external connection diagram

FUNCTIONAL DESCRIPTION, continued

Data Item	Data Description	Interval	Alarm Hi/Lo	Display	Historical	Min	Max	Day
Va	Voltage Input A	1 sec	X	Yes	15 min	X	X	36
Vb	Voltage Input B	1 sec	X	Yes	15 min	X	X	36
Vc	Voltage Input C	1 sec	X	Yes	15 min	X	X	36
Ia	Current Input A	1 sec	X	Yes	15 min	X	X	36
Ib	Current Input B	1 sec	X	Yes	15 min	X	X	36
Ic	Current Input C	1 sec	X	Yes	15 min	X	X	36
In	Current Input Neutral	1 sec	X	Yes	15 min	X	X	36
kWa	Kilowatts phase A pair inputs	1 sec	X		15 min	X	X	36
kWb	Kilowatts phase B pair inputs	1 sec	X		15 min	X	X	36
kWc	Kilowatts phase C pair inputs	1 sec	X		15 min	X	X	36
kW	Kilowatts for feed	1 sec	X	Yes	15 min	X	X	36
kWh Exp	Kilowatt hours - Exported	1 min		Yes	Total	X	X	
kWh Imp	Kilowatt hours - Imported	1 min		Yes	Total	X	X	
kWh Tot	Kilowatt hours - Accumulated	1 min		Yes	Total	X	X	
kVARa	Kilovars phase A pair inputs	1 sec	X		15 min	X	X	36
kVARb	Kilovars phase B pair inputs	1 sec	X		15 min	X	X	36
kVARc	Kilovars phase C pair inputs	1 sec	X		15 min	X	X	36
kVAR	kvar for feed	1 sec	X	Yes	15 min	X	X	36
kVARh Exp	kvarhours - Exported	1 min		Yes	Total	X	X	
kVARh Imp	kvarhours - Imported	1 min		Yes	Total	X	X	
kVARh Tot	kvarhours - Accumulated	1 min		Yes	Total	X	X	
kVAh Exp	kVAhours - Exported	1 min		Yes	Total	X	X	
kVAh Imp	kVAhours - Imported	1 min		Yes	Total	X	X	
kVAh Tot	kVAhours - Accumulated	1 min		Yes	Total	X	X	
Elapsed Time	Elapsed time since last RESET	1 sec		Yes	Total	X	X	
PF	Power Factor	1 sec	X	Yes	15 min			36
Freq	Frequency	1 sec	X	Yes	15 min			36
Ph A	Phase Angle A pair inputs	1 sec						
Ph B	Phase Angle B pair inputs	1 sec						
Ph C	Phase Angle C pair inputs	1 sec						
Pulse Ch 1	Pulse count on channel 1	1 min	X	Yes	15 min			36
Pulse Ch 2	Pulse count on channel 2	1 min	X	Yes	15 min			36
Pulse Ch 3	Pulse count on channel 3	1 min	X	Yes	15 min			36
Pulse Ch 4	Pulse count on channel 4	1 min	X	Yes	15 min			36
Status Ch 1	Status Input on Channel 1	1 cycle	X		10 count MCD			
Status Ch 2	Status Input on Channel 2	1 cycle	X		10 count MCD			
Status Ch 3	Status Input on Channel 3	1 cycle	X		10 count MCD			
Status Ch 4	Status Input on Channel 4	1 cycle	X		10 count MCD			
Relay Out 1	Output Relay Contacts Chan 1	On Demand						
Relay Out 2	Output Relay Contacts Chan 2	On Demand						
Relay Out 3	Output Relay Contacts Chan 3	On Demand						
Relay Out 4	Output Relay Contacts Chan 4	On Demand						
Relay Out 5	Output Relay Contacts Chan 5	On Demand						
Relay Out 6	Output Relay Contacts Chan 6	On Demand						
THD% - a	Total Harmonic Distortion Ph a	1 min	X	Yes				
THD% - b	Total Harmonic Distortion Ph b	1 min	X	Yes				
THD% - c	Total Harmonic Distortion Ph c	1 min	X	Yes				
fund - a	Phase A Fundamental	1 min						
fund - b	Phase B Fundamental	1 min						
fund - c	Phase C Fundamental	1 min						
harm n a*	Phase A Harmonic n	1 min						
harm n b*	Phase B Harmonic n	1 min						
harm n c*	Phase C Harmonic n	1 min						

Note: History is limited to 18 days for the DNP 3.0 option.

* where n is a number corresponding to a harmonic from 2 to 31

SPECIFICATIONS

5 Amp CURRENT INPUTS

Continuous rating:	20A
One second Rating:	400A
Saturation limit:	150A
Burden:	<10milliohms

1 Amp CURRENT INPUTS

Continuous rating:	4A
One second rating:	80A
Saturation limit:	30A
Burden:	<22milliohms

PHASE AC VOLTAGE INPUTS

Continuous rating:	300V, Line to Line
One second rating:	600V, Line to Neutral
Burden:	<1VA @ 300Vac
Sensing:	4-wire wye, 3 and 2½ elements 3-wire wye, 3 elements 3-wire delta, 2½ and 2 elements

INPUT RANGES

Voltage:	0-300Vac RMS
Current:	0-3.0Aac, 1A CT sec. 0-15.0Aac, 5A CT sec.

METERING ACCURACY

Standards

Meets or exceeds IEC 60687 – 1992
Meets or exceeds IEEE C12.20 – 1995

At 50.0Hz or 60.0Hz @ 25° C (0.1 I_{nom} < I < I_{max})

Voltage: ±0.1% of reading
Current: ±0.1% of reading
Watt (at ±0.8PF): ±0.2% of reading
VAR (at ±0.8PF): ±0.2% of reading
Maximum Temperature Error:
±.005%, full scale per °C on V and I
±.010%, full scale per °C on W and vars
Power Factor (at ±0.5PF): 0.55% of reading
Pulse Inputs: 99.999%
Frequency: ±0.01%

kWh, kVARh, and kVAh MEASUREMENTS

kWh (at ±0.8PF): 0.2% of reading
kVARh (at ±0.8PF): 0.2% of reading
kVAh (at ±0.8PF): 0.2% of reading

A/D CONVERTER

Sampling Rate:	64/cycle, adjusted to input frequency 10-75Hz

POWER SUPPLY

Option 1:	DC range 35 - 150V AC range 55 - 135V
Option 2:	DC range 90 - 300V AC range 90 - 270V
Option 3:	DC range 17 - 32V
Burden:	6 watts continuous, 8 watts maximum with all outputs energized

OUTPUT CONTACTS

Contact Current	Operating Voltage	Operational Notes
30 Amps	120Vac	0.2 seconds sustained
10 Amps	250Vac	Continuous
0.3 Amps	250Vdc	Break/Switched
10 Amps	30Vdc	Continuous

CONTROL INPUTS

Wetting voltage range:	DC voltage same as control power supply option.
Nominal Turn On/Off Voltage:	
	P.S. Option 1: 33Vdc
	P.S. Option 2: 83Vdc
	P.S. Option 3: 16Vdc
Burden:	P.S. Option 1: 36KΩ
	P.S. Option 2: 94KΩ
	P.S. Option 3: 15KΩ

COMMUNICATION PORTS

Baud rate:	300 - 19200

IRIG

Supports IRIG Standard 200-98, format B002.
Input Signal: Demodulated (dc level-shifted digital signal)

Logic-High Voltage:	3.5Vdc, minimum
Logic-Low Voltage	0.5Vdc, maximum
Voltage Range:	-10 to +10Vdc
Resistance:	Non-linear, approximately 4 kohms at 3.5Vdc, approximately 3W at 20Vdc

DIELECTRIC STRENGTH

2000 Vac at 50/60 Hz in accordance with IEEE C37.90 and IEC 255-5

SURGE WITHSTAND

Qualified to IEEE C37.90.1-1989

FAST TRANSIENT

Qualified to IEEE C37.90.1-1989

RADIO FREQUENCY INTERFERENCE (RFI)

Qualified to IEEE C37.90.2-1995

SPECIFICATIONS

ELECTRO STATIC DISCHARGE (ESD)

Qualified to European Norm standard EN61000-4-2

ENVIRONMENT

Operating temperature range: -40°C to +70°C (-40°F to +158°F)
Storage temperature range: -40°C to +80°C (-40°F to 168°F)
Humidity: Qualified to IEC 68-2-38, 1st Edition 1974, Basic Environmental Test Procedures, Part 2: Test Z/AD: Composite Temperature Humidity Cyclic Test
Note: LCD Display is inoperative below -20°C.

VIBRATION / SEISMIC

Qualified to IEC255-21-1, Class 1

SHOCK

Qualified to IEC255-21-2, Class 1

CERTIFICATIONS

UL Recognized, File E97033
CSA Certified, File LR23131

CASE SIZE

H1: 10.50"W x 3.47"H x 9.10"D with mounting flanges (8.5"W without mounting flanges)

SHIPPING WEIGHT

H1: Approx. 10 pounds

WARRANTY

7 years

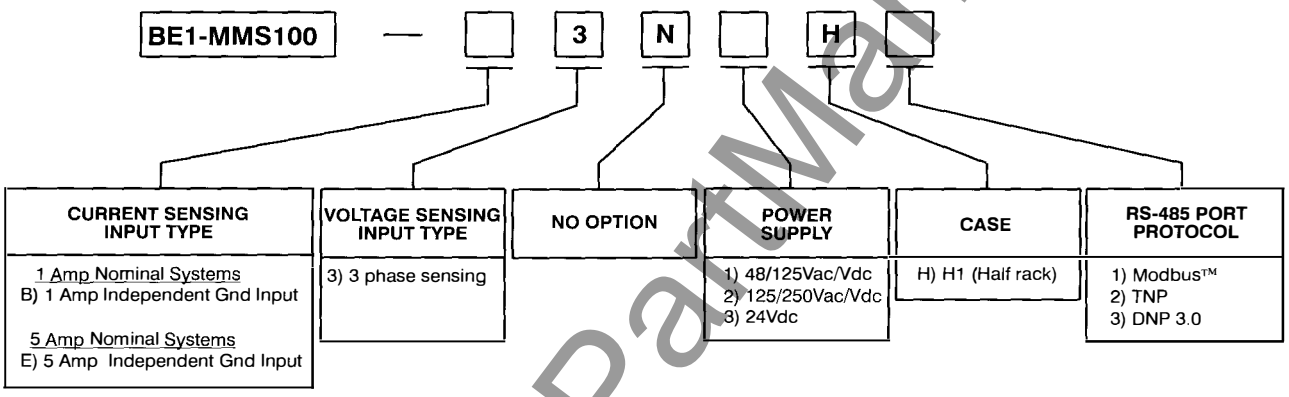
ORDERING

SAMPLE STYLE NUMBER

The style number identification chart defines the electrical characteristics and operation features included in the BE1-MMS100. For example, if the style number were BE1-MMS100 **E3N1H3**, the device would have the following:

BE1-MMS100

(E) - 5 Amp nominal system with 5 Amp Independent Ground Input
(3) - Three phase voltage sensing
(N) - Not applicable
(1) - 48/125Vac/Vdc power supply
(H) - Half rack case
(3) - DNP 3.0 communications



STANDARD ACCESSORIES

9180400108 H1 Test Case with 1 CT Terminal Block and 18-position Bottom Terminal Block

9289900017
Escutcheon plate to panel mount one H1 relay.

9289900016
Escutcheon plate to panel mount two dovetailed H1 relays.

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P.A.E. Les Pins, 67319 Wasselonne Cedex FRANCE
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