BE1-11*g* GENERATOR PROTECTION SYSTEM

DEVICE FUNCTIONS

24	25	27	32
40	43	46	47
50	51	59	60
62	67	81	101
BF	Ethernet Option	Modbus Option	DNP 3 Option

The BE1-11*g* is a multifunction protective system with integrated instrumentation, control and communications features for generation. The system provides voltage controlled, voltage restrained and standard three phase overcurrent protection, as well as phase-residual and independent ground overcurrent measurements, negative sequence overcurrent, and breaker failure. Three phase over/undervoltage, negative and zero sequence voltage, forward and reverse over power, loss of excitation, overexcitation, over/under and rate-of-change of frequency, sync check functions are standard features. The system includes breaker monitoring and control, as well as metering features.

ADVANTAGES

- All overcurrent elements may be individually set for forward, reverse, or nondirectional control. Voltage control and restraint are included within the phase overcurrent elements to provide maximum functional flexibility for the application.
- Four "Tabular Definition" and 24 industry standard timing curves are available for the time overcurrent applications.
- Large high-contrast programmable 128x64 LCD display allows the protective system to replace local instrumentation and alarm annunciation.
- Includes frequency tracking for backup and cogeneration applications.
- Provides separate ground current input for those applications where required.
- High-speed BESTCOMS*Plus* user interface via front panel USB.
- Copper and fiber Ethernet and RS-485 ports provide communication for Modbus™ and DNP3.0 protocols.
- Web page and user-selectable email triggers for remote alarm reporting.
- Expanded non-volatile event memory.
- Includes Real Time Clock with 8-hour ride through and 5-year battery backup.
- Available in fully drawout half rack case.

WINDOWS® SOFTWARE

Interface for setting and communicating with Basler protection products
Request BESTCOMSPlus for BE1-11

ADDITIONAL INFORMATION

INSTRUCTION MANUAL
Request publication 9424200994

MODBUS™ INSTRUCTION MANUAL
Request publication 9424200991

DNP 3.0 INSTRUCTION MANUAL
Request publication 9424200992

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Basler Electric

FEATURES

PROTECTION

- 6 each, Instantaneous Overcurrent (50) elements provide selection of single or three phase, neutral, zero and negative seuqence current measurement. Directional and non-directional operation is a selection Settable definite time delay is available.
- 7 each, Time Overcurrent (51) elements provide selection of single or three phase, neutral, zero and negative sequence current measurement. Voltage control or restraint characteristics may be selected. The reset characteristic may be instantaneous or have an inverse reset characteristic.
- Each Time Overcurrent element may be directional (67/67N) (forward or reverse) or non-directional. Directional control may be selected as Positive (I_1), Negative (I_2) or Zero (I_0) sequence current or zero sequence voltage (V_0).
- 24 industry standard timing curves are available, as well as a user programmable curve, and up to 4 user-defined tabular curves for use by any of the Time Overcurrent elements.
- Minimal transient overreach and overtravel is incorporated into the design of the overcurrent elements.
- An independent ground current input provides zero sequence current polarization and/or ground overcurrent protection.
- Negative sequence overcurrent is a selectable mode of operation for the Time Overcurrent elements.
- 5 Phase Undervoltage (27P) and 4 Phase Overvoltage (59P) elements are available for measurement of phase-to-phase or phase-to-neutral voltage. Sensed voltage may be single or three phase. Undervoltage elements include an undervoltage inhibit setting to prevent erroneous operation.
- 4 Undervoltage (27X) and 4 Overvoltage (59X) elements are available to measure single phase inputs (V_X) or calculated sequence voltages ($3V_0$, V_2(47)). These undervoltage elements include an undervoltage inhibit setting to prevent erroneous operation.
- All voltage elements have a choice of definite or inverse time characteristics.
- Overexcitation, volts-per-Hertz (24) element provides a selection for definite or inverse timing characteristics.
- Sync check (25) with line and bus voltage monitoring logic (25VM).
- 2 directional power (32) elements measure single or three phase power, in the forward or reverse direction, and compare the measurement to an over or under power user setting.
- A choice of Loss of Excitation functional elements is provided. An offset VAR flow algorithm (40Q) provides underexcitation protection. A dual offset mho characteristic (40Z) with voltage suppression provides complete protection for a loss of excitation.
- Fuse loss detection protects against false tripping due to the loss of a sensing voltage (60FL).
- 8 frequency elements may be set individually for over, under, or rate-of-change of frequency. The rate-of-change can be set for positive, negative, or either. Each element can be assigned to either the three phase or single phase (V_X) voltage input. Each element includes an undervoltage inhibit setting.
- Breaker Failure (BF) protection functionality.
- 8 general purpose logic timers (62) and additional logic elements provide added functionality in the user designed BESTLogic*Plus* schemes.
- 4 protection setting groups with external or automatic selection modes.

CONTROL

- Five virtual selector switches (43) are controllabe from both the HMI and communication ports.
- Virtual lockout (86) latches. Status is stored in EEPROM.
- Virtual breaker control switch (101) is controllable from both the HMI and communication ports.
- Communication port control in the virtual switches provides SCADA control of the protective system and circuit breaker.

INSTRUMENTATION

- Real time phase (A, B, C) currents, voltages, and frequency, as well as the calculated neutral current, and negative and zero sequence current and voltage.
- Real Time per phase and 3 phase Watts, Vars, and Power Factor.
- Auxiliary input fundamental and third harmonic voltage.
- Phase angle.
- Demand currents, watts, and vars.

REPORTS

- Current demands for phase, neutral, negative sequence current, and forward and reverse watts and vars. Magnitudes and time stamps are recorded for today's peak, yesterday's peak, and peak since last reset.
- 4000 point log of demand readings.
- kWh and kVarh, forward and reverse.
- Breaker operations counter and contact interruption duty

FAULT RECORDING

- 1028 event sequence-of events report with I/O and alarm sub-reports.
- Fault Reporting - 1 or 2 oscillographic records per fault record.
- 16 fault summary reports. All Fault Summary Records saved in non-volatile memory
- Oscillographic memory will store up to 240 cycles of data @ 32 samples/cycle
- Oscillographic records are in the COMTRADE format.
- Distance-to-fault is calculated using a load compensated algorithm.

COMMUNICATIONS PORTS

- Three independent general purpose communication ports and available protocols:
  - Front USB-B: BESTCOMS*Plus*
  - Rear RS-485: Modbus™ or DNP® 3.0
  - Rear Ethernet: BESTNet*Plus*, BESTCOMS*Plus*, Modbus™ and DNP® 3.0 protocols
  - IRIG-B time sync (unmodulated)

SELF TEST and ALARM FUNCTIONS

- Relay fail, major alarm, and minor alarm LEDs, and fail-safe alarm output contact (open or closed)
  See style chart, page 12, for ordering information.

FEATURES, continued

- More than 20 additional alarm points, user programmable for major or minor priority. Including:
  - Phase current, forward and reverse Watt and Var demand alarm
  - Neutral and negative sequence unbalance demand
  - Three breaker alarm points programmable for slow trip, interruption duty threshold, or operations counter
  - Trip circuit voltage and continuity monitor
  - Close circuit monitor via BESTLogic*Plus*

PROGRAMMABLE I/O

- Four programmable inputs
- Five programmable outputs and one dedicated programmable alarm output

HARDWARE FEATURES

- Case configuration - H1: Half Rack
- Active CT technology for low burden and increased dynamic range
- Flash Memory for upgrading embedded programming
- Real Time Clock with 8 hour capacitor ride through and battery backup
- Integral HMI with *128x64* character display
- Wide range ac/dc power supply options provide long holdup time to ride through dips on ac power source. 100 ms with 4 output relays energized, upon complete loss of source. Starting voltage 125Vac for Option 1 (48/125Vac/dc) and 250Vac for Option 2 (125/250Vac/dc)).

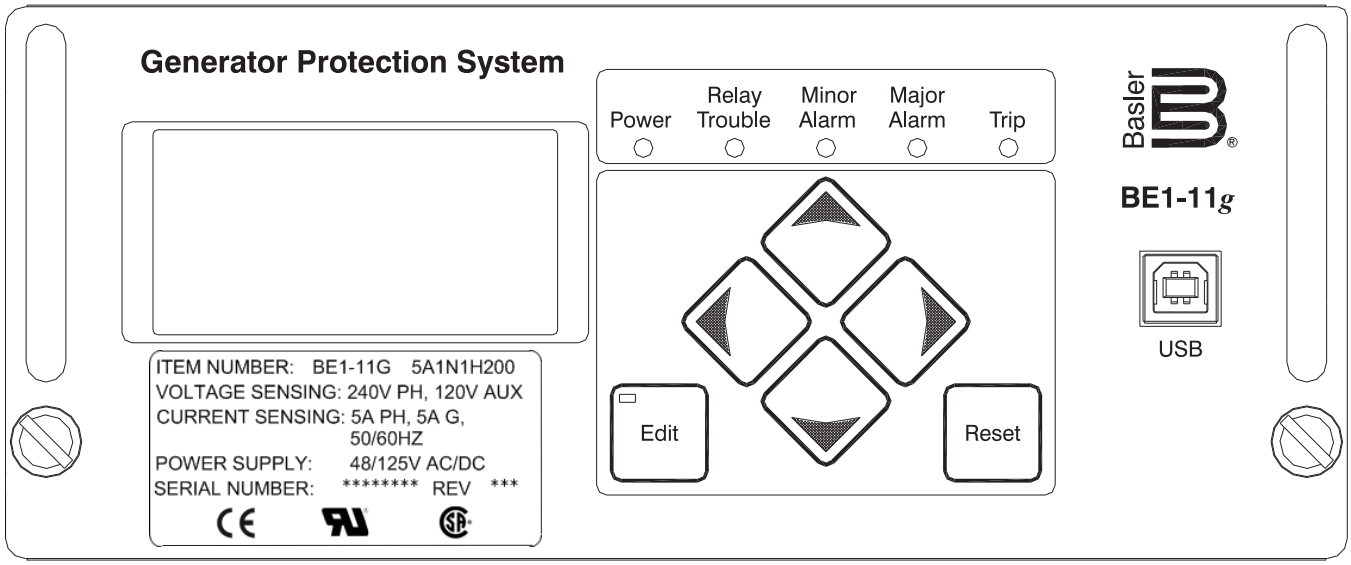


Figure 1 - Advanced HMI (Human Machine Interface)

APPLICATIONS

The BE1-11*g* Generator Protection System provides the three phase, ground, and negative sequence overcurrent, voltage, over/under or rate-of-change of frequency, directional power, loss of excitation, overexcitation, and sync check functions for use in generator protection applications. The unit also may be used in any directional or nondirectional overcurrent application that requires frequency and overexcitation protection and that does not also require a reclosing function. The specialized capabilities of this protective system make it ideally suited for these applications:

- Applications that require the flexibility provided by wide setting ranges, a large number of elements, multiple setting groups, multiple coordination curves, and the versatility of visual programmable logic, in a single compact package.
- Applications that require an economic unit with a space-conscious package. The 11*g* can provide all of the protection, control, instrumentation, and communications required in many installations.
- Applications where small size and limited behind-panel projection facilities are required to modernize an existing installation.
- Applications that require high speed Ethernet communications, copper or fiber.
- Applications where drawout construction is required.

FUNCTIONAL DESCRIPTION

The BE1-11*g* is a multifunction, numerical relay that provides a comprehensive suite of protective functions to detect generator faults and abnormal operating conditions along with control and metering functions in an integrated system. This system is suitable for any generator application and many utility/cogeneration facility intertie applications. 32 sample per cycle digital signal processing, with frequency compensation, extracts the fundamental component for high accuracy with distorted waveforms and at off-nominal frequency operation.

The unit has one set of three phase current and voltage sensing inputs to provide all common protective functions except generator differential, 87G. The voltage sensing circuits automatically configure themselves internally for 1 phase, 3 phase 3 wire, or 3 phase 4 wire VT circuits. A 4th single-phase auxiliary voltage input is available for either generator ground sensing or bus voltage sensing.

The BE1-11*g* has an independent ground current input, typically used for applications with a separate ground CT such as a flux balancing window CT, or to provide ground backup protection for the generator step up transformer.

The half rack case is fully drawout with current circuit shorting provisions. Two Basler Electric half rack IEDs (Intelligent Electronic Devices) such as primary and backup BE1-11*g* or the BE1-11*i* Intertie Protection Systems can be dovetailed together to mount in a standard 19" equipment rack with no special mounting hardware.

Three independent communications ports, along with built-in support for Modbus® and other common protocols, provide easy access to integrating the protection, control, metering, and status monitoring functions into a substation automation system. The standard IRIG-B port provides time synchronization from a master clock.

Tripping by voltage dependent functions 27, 59, 32 will be blocked if a sensed voltage is lost (60FL).

The target reporting function in the BE1-11*g* automatically adapts the targets as appropriate. For example, if both the **50-2** and the **51-1** are set for directional control and trip for a fault involving a phase, they post targets for an A phase fault as "**50-2 67 A**" for the directional instantaneous trip or "**51-1 67 A**" for the directional time trip.

Three independent communications ports are available in the unit. The front panel USB port provides for BESTCOMS*Plus* communications with the relay. The rear panel RS-485 and optional Ethernet ports provide support for BESTCOMS*Plus*, BESTNet*Plus*, Modbus, and DNP 3.0 protocols. Modbus or DNP 3.0 are supported through the RS-485 port. The Ethernet port will support concurrent Modbus and DNP 3.0 or two concurrent sessions of DNP 3.0. The Ethernet port may be defined at the time of order to be either a copper (RJ-45) or multi-mode fiber optic connection.

A standard IRIG-B port provides time synchronization for the relay from an external GPS clock.

Real time metering provides Watt, Watt-hour, VAR, VAR-hour, Voltage, Amp, and unbalance loading telemetry for the protected equipment. Contact sensing inputs and alarm monitoring functions provide real time status information. Remote control is provided by virtual control and selector switches with select-before-operate control of programmable outputs.

Figure 2 shows alternate external connections for Vx and IG. Figures 3A and 3B illustrate typical sensing connections for stator ground faults, sync check and ground differential protection. Figure 4 illustrates the functionality contained within this device, and Figure 5 shows rear panel connections.

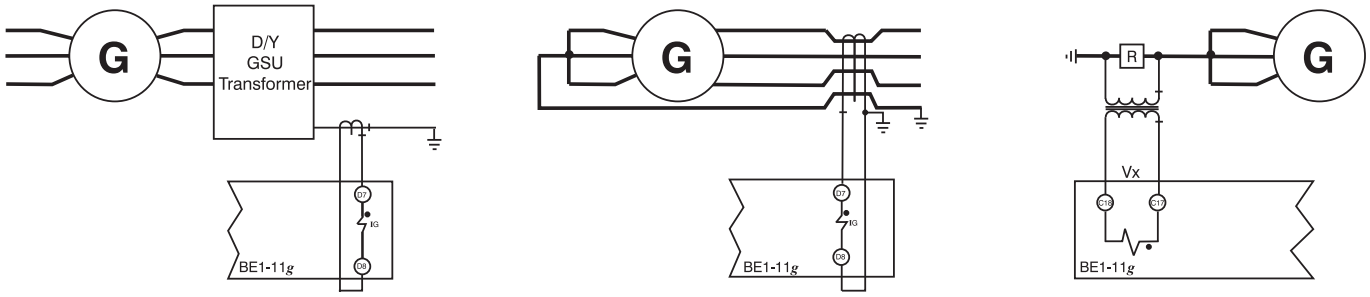
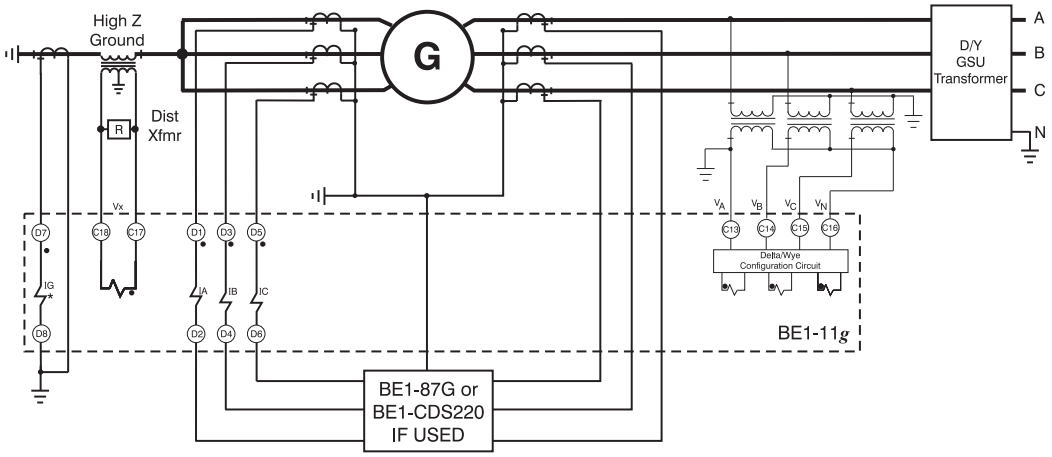


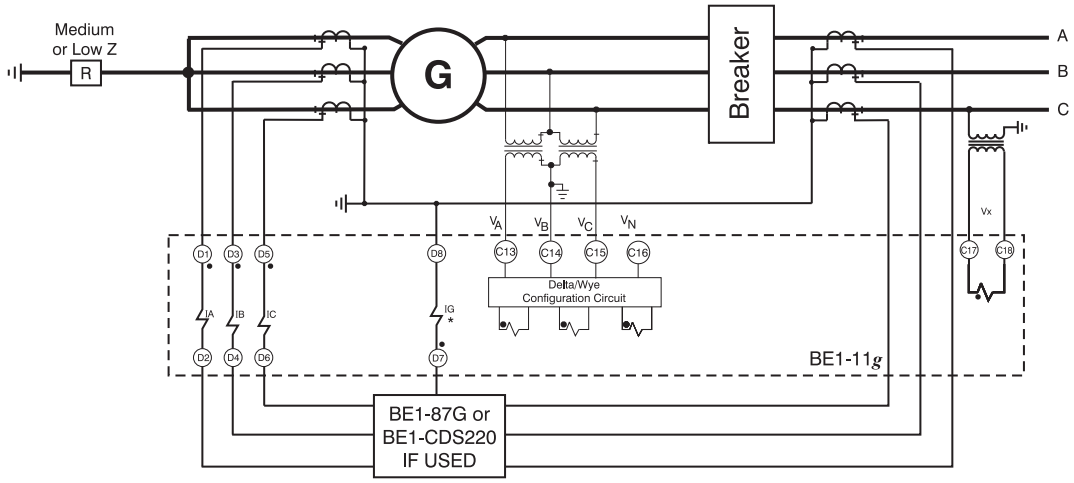
Figure 2 - Typical Alternate Connections for Vx and IG

FUNCTIONAL DESCRIPTION, continued



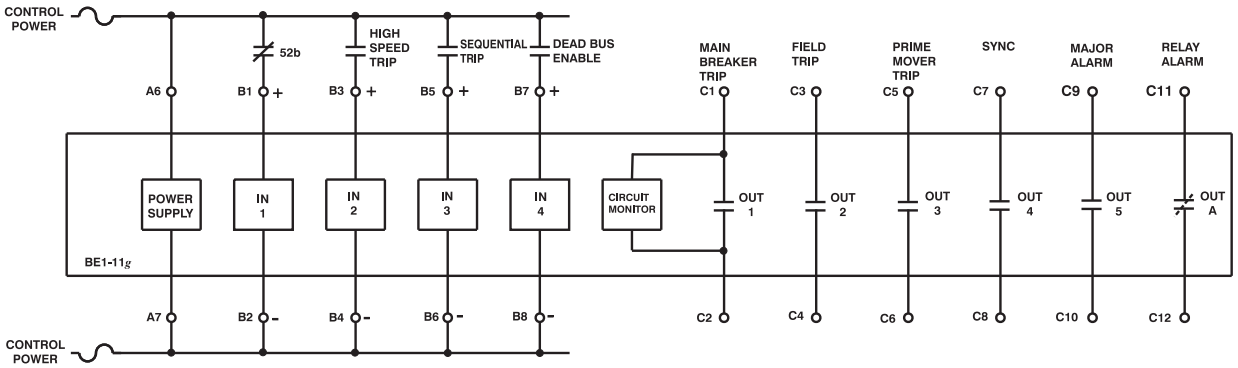
* Independent Ground input is optional.

Figure 3A - Typical External Sensing Connections, with Vx and IG Used for Stator Ground Fault



* Independent Ground input is optional.

Figure 3B - Typical External Sensing Connections, with Vx Used for Sync Check and IG Used for Ground Differential Overcurrent



NOTES:

1.) CONNECTIONS SHOWN ARE FOR USE WITH PRE-PROGRAMMED LOGIC SCHEME LZ-W-25. LZ-W-25 PROVIDES LOW IMPEDANCE GROUNDED GENERATOR PROTECTION WITH SEQUENTIAL TRIP AND SYNC CHECK LOGIC. ALL INPUTS AND OUTPUTS ARE FULLY PROGRAMMABLE USING BESTlogic.

Figure 4 - Typical External Connections

FUNCTIONAL DESCRIPTION, continued

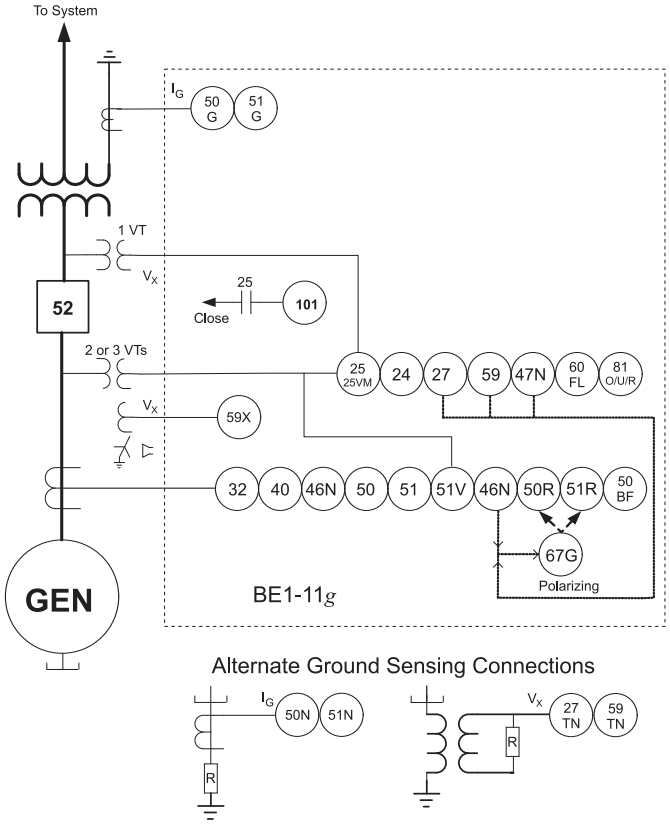


Figure 5 - BE1-11*g* Generator Application

BESTLogic*Plus*

BESTLogic*Plus* programmable logic provides the user with high flexibility in configuring a protection and control system.

Each of the protection and control functions in the BE1-11*g* is implemented as an independent function block that is equivalent to its single function, discrete device counterpart. Each independent function block has all the inputs and outputs that the discrete component counterpart might have. Figure 6 shows a sample BESTLogic*Plus* screen available in the BE1-11*g*. Programming BESTLogic*Plus* is equivalent to choosing the functional devices required by your protection and control scheme and drawing schematic diagrams to connect the inputs and outputs to obtain the desired operational logic.

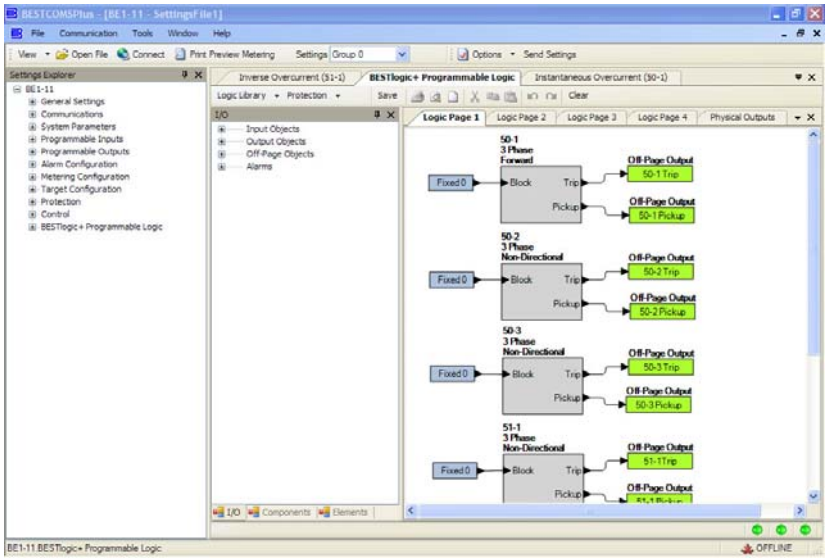


Figure 6 - BESTLogic*Plus* Programmable Logic, Sample Screen

The BE1-11*g* relay can store, as user settings, one user programmable, custom logic scheme. To save time, several preprogrammed logic schemes also are provided. Any of the preprogrammed schemes may be copied into the logic settings without making any additional BESTLogic*Plus* settings.

BESTLogic*Plus* provides the protection engineer with the flexibility to set up this powerful multifunction system with the same freedom that was once enjoyed with single function, discrete devices. It is no longer necessary to compromise your standard protection and operating practices to deal with the limitations in programmability of previous multifunction devices. In addition, these advanced logic features have been added: Edge triggers, XOR gates, logic timers, counters, and latches.

FUNCTIONAL DESCRIPTION, continued

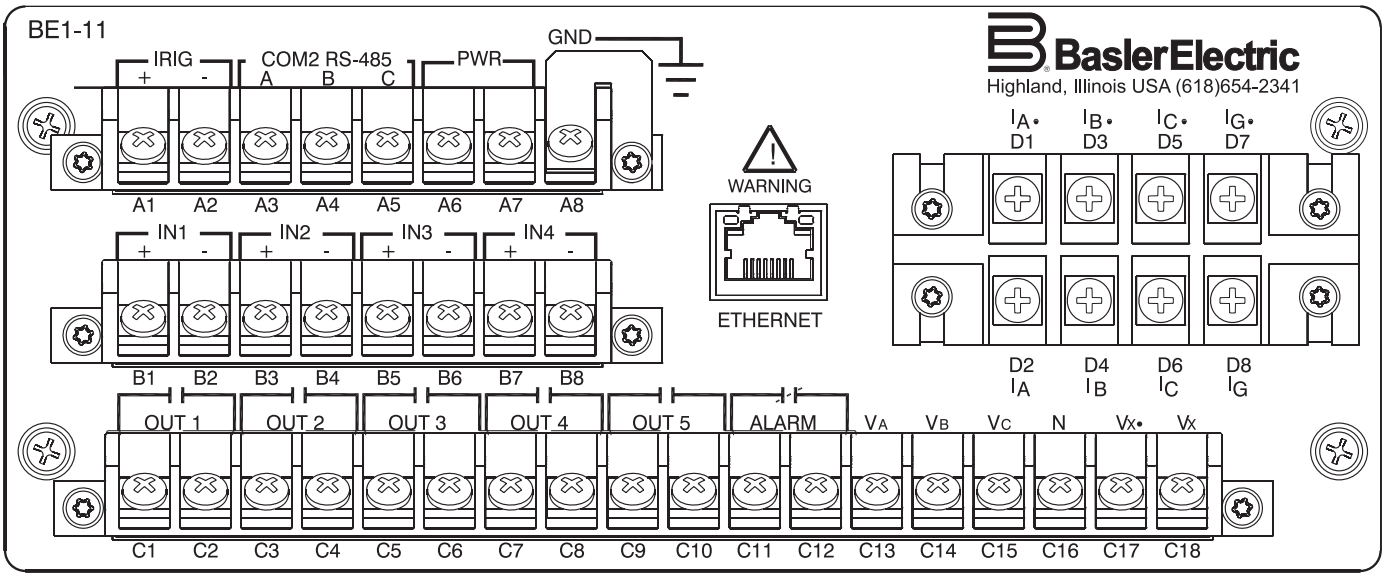


Figure 7 - BE1-11*g* H1 Rear Panel Connections (shown with optional copper Ethernet port)

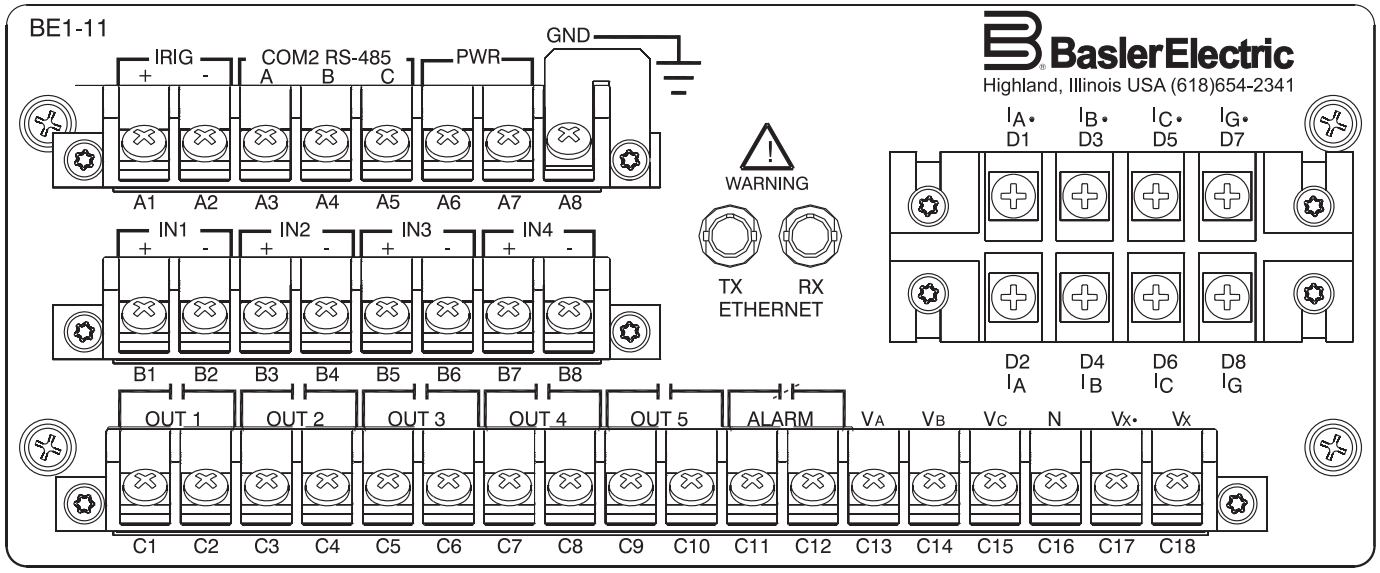


Figure 8 - BE1-11*g* H1 Rear Panel Connections (shown with optional Fiber optic Ethernet port)

GENERAL SPECIFICATIONS

5 Amp CURRENT INPUTS

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

1 Amp CURRENT INPUTS

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

PHASE AC VOLTAGE INPUTS

Continuous:	300V, Line to Line
One Sec. rating:	600V, Line to Neutral
Burden:	Less than 1VA @ 300Vac

AUXILIARY AC VOLTAGE INPUT (V_x)

Continuous:	150V
One Sec. rating:	600V
Burden:	Less than 1VA @ 150Vac

A/D CONVERTER

Sampling Rate:	32/cycle, adjusted to input frequency 10-75Hz

POWER SUPPLY

Option 1: 48/125Vac/dc	DC range 35-150V AC range 55-135V
Option 2: 125/250Vac/dc	DC range 90 - 300V AC range 90 - 270V
Option 3: 24Vdc	DC range 17 - 32V (down to 8V for momentary dips)
Burden:	10 Watts continuous, 12 Watts maximum with all outputs energized

TRIP CONTACTS

Make and carry:	30A (0.2sec)
Continuous:	7A
Break:	0.3A DC (L/R=0.04)

CONTROL INPUTS

Wetting voltage range:

Power Supply Option	Low Range		High Range	
	Turn-on Voltage Range	Burden	Turn-on Voltage Range	Burden
1) 48/125Vac/Vdc	26-38V	123.76k ohms	69-100V	66.49k ohms
2) 125/250Vac/Vdc	69-100V	53.65k ohms	138-200V	21.15k ohms
3) 24Vdc	5-8Vdc	6.15k ohms	N/A	N/A

Control inputs recognize both DC and AC voltages.

COMMUNICATION PORTS

Response time:	<100mSec for metering and control functions
Baud rate:	Up to 115,200

ELECTRICAL ENVIRONMENT

- IEEE C37.90-1989 Standard for Relays and Relay Systems Associated with Electric Power Apparatus
- IEC 255-5 Insulation Test for Electrical Relays Impulse and Dielectric Strength (2000Vac at 50/60Hz)
- IEEE C37.90.1-1989 Standard Surge Withstand Capability Tests for Relays and Relay Systems Associated with Electric Power Apparatus
- IEC 255-22-1 1MHz Burst Disturbance Tests for Electrical Disturbance Tests for Measuring Relays and Protection Equipment
- EN 61000-4-4 Electrical Fast Transient/Burst Immunity Test
- EN 61000-4-3 Radiated, Radio-frequency, Electromagnetic Field Immunity Test
- Type tested using a 5-watt, hand-held transceiver in the ranges of 144 and 440MHz with the antenna placed within 6 inches of the relay.
- IEEE C37.90.3 (Jan. 01) Draft Standard Electrostatic Discharge Tests for Protective Relays
- EN 61000-4-2 Electrostatic Discharge Immunity Test

MECHANICAL ENVIRONMENT

- Operating temperature range: -40°C to 70°C* (-40°F to 158°F)
  *LCD Display is inoperative below -20°C.
- Storage temperature range: -40°C to 70°C (-40°F to 158°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
- Qualified to IEC 255-21-1 (Class 1) Vibration Tests for Electrical Relays
- Qualified to IEC 255-21-2 (Class 1) Shock and Bump Tests for Electrical Relays

CERTIFICATIONS

UL recognized per Standard 508, File E97033
CSA certified per Standard CAN/CSA-C22-2
Gost R certified per relevant standards of Gosstandart of Russia
CE qualified - meets or exceeds standards for distribution in the European Community

CASE SIZE

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

SHIPPING WEIGHT

Approx. 12 pounds (5.4 kg)

WARRANTY

7 years

PERFORMANCE SPECIFICATIONS

INSTANTANEOUS OVERCURRENT WITH SETTABLE DELAY (50)

Pickup: 5A CT 0.5 - 150.0A
1A CT 0.1 - 30.0A
PU time with TD = 0.000 Sec
2 cyc for P, N &G @ 5 x PU
3 cyc for Q @ 5 x PU
Delay time: 0.000 - 60 sec
Time Accuracy: ±0.5% or ±½ cyc for P and N
±0.5% or ±1 cyc for Q

TIME OVERCURRENT (51)

Pickup: 5A CT 0.5 - 16.0A
1A CT 0.1 - 3.20A
Time dial: TD=K=0 - 99 for 46 curve
TD=0.0 - 9.9 for all other curves
Time-Current Characteristics:
The following expression describes the inverse time current characteristic for each curve:

$$T_T = \frac{AD}{M^N - C} + BD + K = \text{Time to trip}$$

$$T_R = \frac{RD}{M^2 - 1} = \text{Time for decaying reset}$$

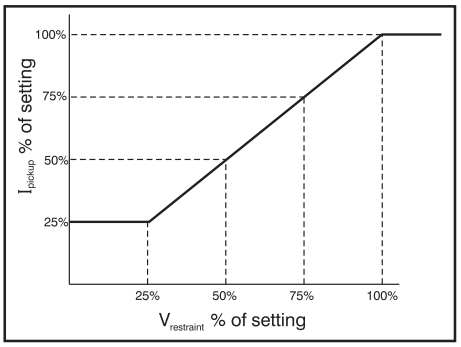
where D = Time dial, M = Multiple of PU and A, B, C, N, K and R are constants that govern the shape of each curve. The protection engineer can set the constants for the P (programmable) curve to achieve virtually any characteristic.

CURRENT PICKUP ACCURACY (All 50 and 51)

Phase and Ground:	5A	2% or 50mA
	1A	2% or 10mA
Neutral and Negative Sequence:	5A	3% or 75mA
	1A	3% or 75mA

51P VOLTAGE CONTROL (27R)

Control Modes: Uncontrolled, voltage controlled, voltage restrained.
Control/Restraint Range: 30 - 250V
Restrained Mode Characteristic: (see below)



NEGATIVE SEQUENCE OVERCURRENT (46)

Pickup: 5A CT 0.1-16.0A
1A CT 0.02-3.20A
Time dial: TD=K=0-99 for 46 curve
TD=0.00-9.9 for all other curves
Time-Current Characteristics: Same curves as 51 elements

Curve Type	Constants					
	A	B	C	N	K	R
S1	0.2663	0.03393	1.000	1.2969	0.028	0.5000
S2	0.0286	0.02080	1.000	0.9844	0.028	0.0940
L1	5.6143	2.18592	1.000	1.000	0.028	15.750
L2	2.3955	0.00000	1.000	0.3125	0.028	7.8001
D	0.4797	0.21359	1.000	1.5625	0.028	0.8750
M	0.3022	0.12840	1.000	0.5000	0.028	1.7500
I1	8.9341	0.17966	1.000	2.0938	0.028	9.0000
I2	0.2747	0.1042	1.000	0.4375	0.028	0.8868
V1	5.4678	0.10814	1.000	2.0469	0.028	5.5000
V2	4.4309	0.0991	1.000	1.9531	0.028	5.8231
E1	7.7624	0.02758	1.000	2.0938	0.028	7.7500
E2	4.9883	0.0129	1.000	2.0469	0.028	4.7742
A	0.01414	0.00000	1.000	0.0200	0.028	2.0000
B	1.4636	0.00000	1.000	1.0469	0.028	3.2500
C	8.2506	0.00000	1.000	2.0469	0.028	8.0000
G	12.1212	0.00000	1.000	1.0000	0.028	29.0000
F	0.0000	1.00000	0.000	0.0000	0.028	1.0000
46	*	0.00000	0.000	2.0000	0.028	100.0000
A1	0.1400	0.00000	1.000	0.0200	0.000	2.0000
B1	13.5000	0.00000	1.000	1.0000	0.000	3.2500
C1	80.0000	0.00000	1.000	2.0000	0.000	8.0000
D1	0.0515	0.11400	1.000	0.0200	0.000	4.8500
E3	19.6100	0.49100	1.000	2.0000	0.000	21.6000
F1	28.2000	0.12170	1.000	2.0000	0.000	29.1000
P	0 to 600	0 to 25	0 to 1	.5 to 2.5	0.028	0 to 30
T	User defined currents and time delays.					

S1, S2 = CO Short Inv, IAC Short Inv
L1, L2 = CO Long Inv, IAC Long Inv
D = CO Definite Time
M = CO Moderately Inverse
I1, I2 = CO Inverse, IAC Inverse
V1, V2 = CO Very Inv, IAC Very Inv
E1, E2 = CO Ext Inverse, IAC Ext. Inverse
A = IEC Standard Inverse
B = IEC Very Inverse
C = IEC Extremely Inverse
G = IEC Long Time Inverse
F = Fixed Time
46 = Negative Sequence Overcurrent
P = Programmable
T** = Table Lookup (T1 through T4)

* Constant A is variable for the 46 curve and is determined as necessary based on system full load current setting, minimum pickup, and K factor settings.
** Tabular curve definition may include up to 40 points for each of 4 user-defined curves.

BREAKER FAILURE (50BF)

Time: 50 - 999mSec
Dropout: 5A CT 0.5A
1A CT 0.1A
Time Accuracy: ±0.5% or +1¼ cyc / - ½ cyc

DIRECTIONAL CONTROL (ALL OVERCURRENT)

Mode: Forward, Reverse, Nondirectional
67P Polarization: Positive Sequence w/Memory or Negative Sequence
67Q Polarization: Negative Sequence
67N Polarization: Selectable any combination
Zero Sequence Voltage (Requires 4W VT)
Zero Sequence Current (Requires IG)
Negative Sequence Current

PERFORMANCE SPECIFICATIONS, continued

VOLTS/HZ (24)

Pickup: 0.5 - 6V/Hz
Delay Time: Inverse Squared Curve

$T_T = \frac{D_T}{(M-1)^2}$ $T_R = D_R \times \frac{ET}{FST} \times 100$

T_T = Time to Trip
T_R = Time to Reset
D_T = Time Dial, Trip
D_R = Time Dial, Reset
$M = \frac{\text{Actual V/Hz}}{\text{Pickup V/Hz}}$
ET = Elapsed Time
FST = Full Scale Trip Time (T_T)

SYNC CHECK (25)

Delta Phase Angle: 1 - 99 degrees
Delta Voltage Magnitude: 1 - 20V
Delta Frequency: 0.01 - 0.50Hz
Phase Shift CompensatioN: 0 - 359 degrees

SYNC CHECK, VOLTAGE MONITOR (25VM)

Dead Threshold: 10 - 150V
Live Threshold: 10 - 150V
Dropout Time Delay: 0.050 - 60.0sec
Logic: Dead Phase/Dead Aux.
Dead Phase/Live Aux.
Live Phase/Dead Aux.
Two Independent outputs: 25VM1 and 25VM2

PHASE OVER/UNDERVOLTAGE (27P, 59P)

Mode: 1 of 3; 2 of 3; 3 of 3
Pickup: 10.0-300V_{L-L} or 10.0-300V_{L-N}
Delay Time: 0.050 - 600sec.
Inverse delay equations:
For overvoltage protection $t(G) = \frac{TD}{(G/G_S)-1}$

For undervoltage protection $t(G) = \frac{TD}{1-(G/G_s)}$

where
t(G)=operating time with constant value of *G (seconds)*
TD=time multiplier setting
G=measured value of the characteristic quantity
G_S=setting (pickup) value of the characteristic quantity

AUXILIARY OVER/UNDERVOLTAGE 3V0 (27X, 59X)

Mode: Fundamental V_X,
3 phase Residual (3V0),
3rd Harmonic V_X
Pickup: 1.0 - 150V
Delay Time: 0.050 - 600 Sec.
Inverse Delay: ±5% or 2 cycles

VOLTAGE PICKUP ACCURACY (All 27, 47 and 59)

Phase (V_{L-L} or V_{L-N}): ±2% or ±0.5V
Phase 3V0 and V2: ±2% or ±0.5V

DEFINITE TIME ACCURACY (All 27, 47 and 59)

Definite Time Accuracy: ±0.5% or ±1 cyc

NEGATIVE SEQUENCE OVERVOLTAGE (47)

Pickup: 1.0 - 300V_{L-N}
Delay Time: 0.050 - 600sec.

POWER (32)

Mode: Forward, Reverse
Pickup: 5A: 1.0 - 6000 Watts, 3 ph
1A: 1.0 - 1200 Watts, 3 ph
Pickup Accuracy: ±3%
Delay Time: 0.050 - 600 Sec.

UNDEREXCITATION (40Q)

Pickup: 5A: 1.0 - 6000 VARs, 3 ph
1A: 1.0 - 1200 VARs, 3 ph
Pickup Accuracy: ±3%
Delay Time: 0.050 - 600sec.

LOSS OF EXCITATION (40Z) Dual element

Offset: 0 - 110 Ohms, 5 Amp
0 - 550 Ohms, 1 Amp
Diameter: 0.1 - 100 Ohms, 5 Amp
0.5 - 500 Ohms, 1 Amp
Accuracy: ±3%
Time Delays: 0.0 - 60sec.

FREQUENCY (81)

Mode: Over, Under
Pickup: 20.00 - 70.00 Hz
Delay Time: 0.000 - 600 Sec.
Time Accuracy: ±0.5% or +1 cyc / -0 cyc
(Min. trip time affected by min. 3 cyc security count)
Mode: Rate of Change (ROC)
Pickup: 0.2-20Hz/sec
Accuracy: 0.1 Hz/sec or 2%

GENERAL PURPOSE LOGIC TIMERS (62)

Mode: PU/DO
1 Shot, Non-Retrig.
1 Shot, Retrig.
Integrating
Latch
T1 and T2 Delay Time: 0.000 - 9999 Sec.
Time Accuracy: ±0.5% or ±¾ cyc

PERFORMANCE SPECIFICATIONS, continued

SETTING GROUPS

Setting Groups:	4
Control Modes:	Automatic: CLP Dynamic load or unbalance External: Discrete input logic; Binary: Input Logic

METERING

Current Range:	5A	0.5 to 15.0
	1A	0.1 to 3.0
Current Accuracy:	±1%	
Phase Voltage Range:	3W	0 - 300 V_{L-L}
	4W	0 - 300 V_{L-L}
Phase Voltage Accuracy:	±0.5% for 50V<V_{L-L}<300V	
Watt/VAR:	5A	0 to ±7500
	1A	0 to ±1500
Watt Accuracy:	1% @ Unity PF	
VAR Accuracy:	1% @ Zero PF	
Energy:	0 to ±1.0E12 (F/R registers)	
Frequency:	10 - 75Hz	
Frequency Accuracy:	0.01Hz	

DEMANDS (IA, IB, IC, IN, IQ, Fwd Watts, Rvs Watts, Fwd VARs, Rvs VARs)

Demand Interval:	1 - 60 min.
Demand Mode:	Thermal

BREAKER MONITORING

Duty Mode:	I or I^2
Duty Alarm Range:	0 - to 100%
Op Counter Alarm Range:	0 - 99999
Trip Time Alarm Range:	20 - 1000mSec

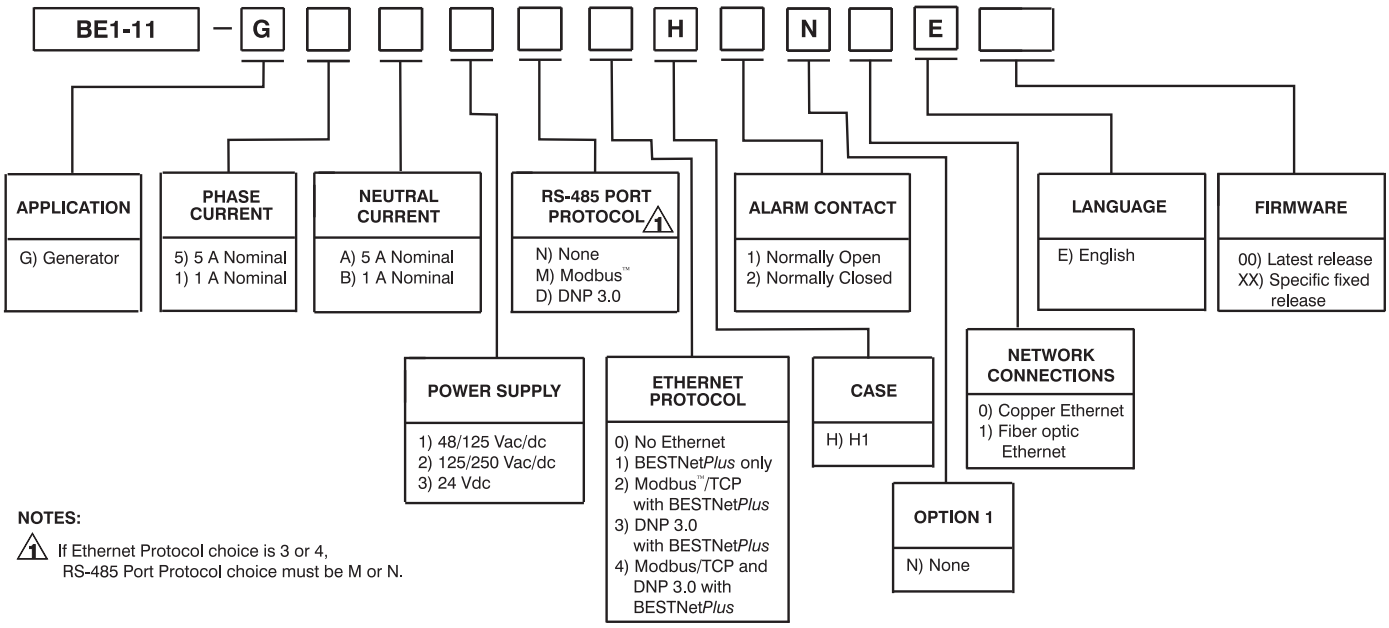
ORDERING

SAMPLE STYLE NUMBER

The style number identification chart defines the electrical characteristics and operation features included in BE1-11 relays. For example, if the style number is BE1-11 **G5A1M2H2N1E00**, the device has the following:

BE1-11

(G) - Generator Application
(5) - 5 Amp Phase nominal current
(A) - 5 Amp Neutral nominal current
(1) - 48/125 Vac/Vdc power supply
(M) - Modbus protocol
(2) - Modbus/TCP with BESTNet*Plus*
(H) - Half Rack Case
(2) - Normally Closed Alarm
(N)
(1) - Fiber optic Ethernet
(E) - English language
(00) - Latest release of firmware



NOTES:

1 If Ethernet Protocol choice is 3 or 4, RS-485 Port Protocol choice must be M or N.

STANDARD ACCESSORIES

9289900016 Escutcheon plate to panel mount two dovetailed H1 relays.
9289900017 Escutcheon plate to panel mount one H1 relay.
9289924100 Adapter bracket to mount single H1 case in 19" rack.
9289929100 Adapter bracket with cutout for ABB FT test switch, to mount a single H1 case in a 19" rack.

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