

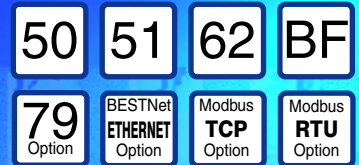
BE1-700C



Digital Overcurrent
Protective Relay



DEVICE FUNCTIONS



The BE1-700C is a compact multifunction, numeric relay that provides three phase, ground, and negative sequence overcurrent protection with breaker failure, breaker monitoring, control, and metering functions in an integrated system. Four shot reclosing is available as an option. An onboard Ethernet option can provide Modbus/TCP connectivity or can provide web and email capabilities.

ADVANTAGES

- All of the advantages of a fully numeric product in an economical "current only" protection package.
- Compact design requires minimal panel space for overcurrent and reclosing applications.
- Adds Oscillography, Sequence of Events, and Metering when single function current relays are replaced with the BE1-700C.
- BESTlogic provides the user with complete flexibility in configuring a protection and control system. User programmable variable and switch names make these relays completely self documenting.
- Programmable LCD display allows the relay to replace local indication and control functions, such as panel metering, alarm annunciation, and control switches.
- Two independent communication ports with protocol support allows integration with distributed control systems.
- Available with or without reclosing.
- Optional BESTNet Ethernet package provides metering and status web pages, settings and configuration via Ethernet, and email notification of user-defined events.

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WINDOWS® SOFTWARE

Interface for setting and communicating with Basler numeric relays

ADDITIONAL INFORMATION

Instruction Manual

Request publication 9376700990

MODBUS™ Instruction Manual

Request publication 9376700991

VOLTAGE VERSION ALSO AVAILABLE

A voltage version of the BE1-700 is also available. See Bulletin URD-V.



PROTECTION

- Phase, Neutral, and Negative Sequence Instantaneous Overcurrent elements with settable time delay: 50TP, 150TP, 50TN, 150TN, 50TQ, 150TQ
- Phase, Neutral, and Negative Sequence Time Overcurrent elements: 51P, 51N, 51Q, 151N
- U.S. and IEC timing curves plus user programmable curve
- Minimizes transient overreach and overtravel on overcurrent elements
- Separate ground current input
- Breaker Failure protection function: BF
- Two general purpose logic timers: 62, 162
- Programmable Logic using BESTlogic
- Two protection setting groups with external or automatic (cold load pickup, load, unbalance, recloser shot) selection modes

CONTROL

- Virtual breaker control switch—controllable from both HMI and com. ports: 101
- Two virtual selector switches—controllable from both HMI and com. ports: 43 and 143
- Optional four shot recloser, including separate pilot and time delayed reclose initiates, with zone sequence coordination and sequence controlled protective element blocking functions.

INSTRUMENTATION

- Real time A, B, C phase, neutral, and negative sequence currents
- 1% meter accuracy down to 10% of nominal current

REPORTS

- Current demands for phase, neutral, and negative sequence currents—magnitudes and time stamps are recorded for today's peak, yesterday's peak, and peak since reset
- Breaker operations counter and contact interruption duty

FAULT RECORDING

- Fault summary reports: 16 total. Two most recent Fault Summary Records saved to non-volatile memory
- SER: 255 event sequence of events report with I/O and alarm sub-reports
- Oscillography:
 - Up to 16 fault records, 15 cycles long @ 12 samples/cycle
 - 1 or 2 oscillography records per fault report
 - COMTRADE 97 or 99 format

COMMUNICATION PORTS

- Two independent general purpose communication ports
 - Front RS-232 ASCII communications
 - Rear RS-485 ASCII or optional Modbus™ protocols
- IRIG-B time sync (demodulated), TTL
- Optional 10/100 BaseT Ethernet port with BESTNet Easy Ethernet or with Modbus/TCP protocol

SELF TEST AND ALARM FUNCTIONS

- Relay fail, major alarm, and minor alarm LEDs, and fail-safe alarm output contact
- Extensive internal diagnostics monitor all internal functions of the relay
- More than 20 additional alarm points—programmable for major or minor priority Including:
 - Reclose fail and lockout
 - Phase demand overload alarm
 - Neutral and negative sequence unbalance demand alarms
 - 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

PROGRAMMABLE I/O

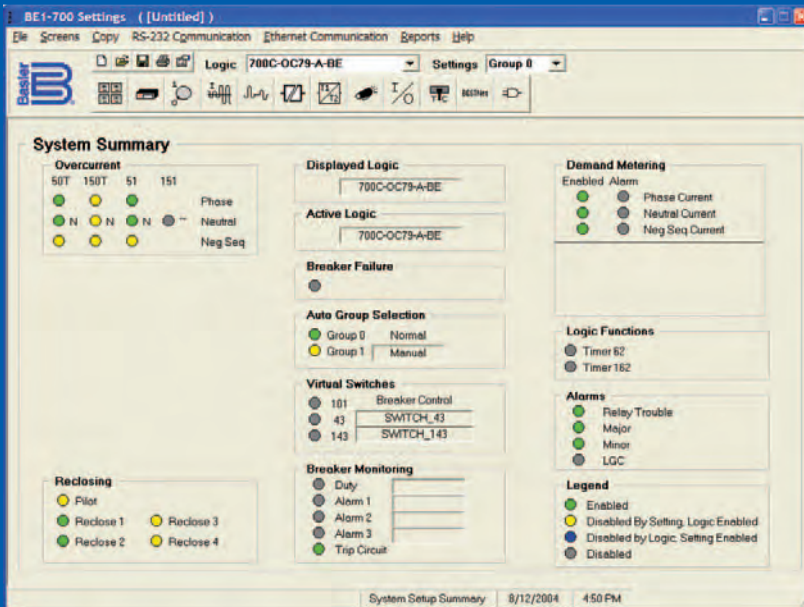
- Four programmable inputs
- Five programmable outputs and one dedicated programmable alarm output

HARDWARE FEATURES

- 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
- Compact panel mount case with integral mounting studs for a clean installation. Less than 3/8" projection in front of panel.

BESTCOMS™ SOFTWARE

Free, easy to use settings program



BESTCOMS Screen, showing at a glance
which relay functions have been enabled

BESTCOMS allows you to:

- Enter settings and BESTlogic logic equations for the BE1-700
- Save settings to a file
- Save BESTlogic logic schemes (without settings) to a "Logic Library" file
- Print settings
- Upload and download settings via Serial port
- Upload and download settings via Ethernet (with BESTNet option)
- View real-time metering and status when connected to a relay
- View fault records and SER data when connected to a relay
- View COMTRADE oscillographic records (with included BESTwave program)
- FREE! with every order

APPLICATIONS

The BE1-700C Overcurrent Protection System provides three phase, ground, and negative sequence overcurrent protection and is intended for use in any non-directional overcurrent protection application. Its unique capabilities make it ideally suited for applications with the following requirements:

- Applications that require low burden to extend the linear range of CTs.
- Applications that require the flexibility provided by wide setting ranges, multiple setting groups, and multiple coordination curves in one unit.
- Applications that require the economy and space savings provided by a multi function, multiphase unit. This one unit can provide all of the protection, as well as local and remote indication, metering, and control functions required on a typical circuit.
- Applications that require communication capability.
- Applications that require a fundamental digital signal processing (DSP) algorithm to provide rejection of harmonics and low transient overreach.
- Applications where bus protection is provided by a high speed bus overcurrent blocking scheme instead of a dedicated bus differential circuit.
- Applications where the capabilities of intelligent electronic devices (IEDs) are used to decrease relay and breaker maintenance costs.
- Applications using Ethernet communication, programmable email notifications, and live metering information via an embedded web server (with BESTNet option).
- Applications requiring Modbus/TCP Ethernet communications (with Modbus/TCP option).



The BE1-700C is a multifunction, numeric relay that provides a comprehensive mix of protective, control and metering functions in an integrated system. This system is suitable for any nondirectional overcurrent application including feeder applications, generator/motor applications, cogeneration applications, and transformer backup.

The unit has one set of three phase and neutral current sensing inputs to provide all common protective functions for typical power distribution overcurrent protection applications.

Two independent communications ports, along with built-in support for Modbus™ or Modbus TCP, 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.

Real time metering provides amp and unbalance loading telemetry for the protected circuit. 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.

BESTlogic

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

Each of the protection and control functions in the BE1-700C 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. Figures 5 and 5a show each of the independent function blocks available for use in the BE1-700C.

Programming BESTlogic is equivalent to choosing the devices required by your protection and control scheme and drawing schematic diagrams to connect the inputs and outputs to obtain the desired operational logic.

The BE1-700C relay can store, as user settings, one user programmable, custom logic scheme. To save you time, several preprogrammed logic schemes have also been provided. Any of the preprogrammed schemes may be copied into the logic settings without making any additional BESTlogic settings.

BESTlogic 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.

Figures 1A, 1B, 1C, and 2 show typical external connections, and Figure 4 shows rear panel connections.



BESTNet ETHERNET OPTION

The BESTNet option connects your BE1-700C relay to the wired world.

BESTNET features include:

- Embedded web server with metering, status, and fault summary information*
- Email alerts of as many as seven user-defined conditions**
- Full BESTCOMS support over Ethernet
- Full Basler ASCII protocol for terminal mode communications (TELNET) or custom programmed application access
- Support for DHCP or static IP addressing. IP Discovery function included in BESTCOMS.

* A web browser with a Java™ Runtime environment installed is required to view web pages.

** An external SMTP email server must be available to use email alerts.

Available with BESTNet
Easy Ethernet

Current	
IA	0.99
IB	1.0
IC	0.99
IN	0.02
IQ	0.01
IG	0.02

BE1-700 Status
[Refresh]

Sample BESTNet Web Page

Modbus/TCP ETHERNET OPTION

Instead of the BESTNet option, the BE1-700 can be ordered with the Modbus/TCP option. With Modbus/TCP, your BE1-700 relay offers a true Modbus/TCP protocol connection via an internal 10/100 BaseT port. No clumsy external adaptors are required! Simply plug in an Ethernet cable and your BE1-700 is part of your Modbus/TCP network.

NOTE: Modbus/TCP and BESTNet are mutually exclusive. The Ethernet port can be used for BESTNet or Modbus/TCP, but not both.

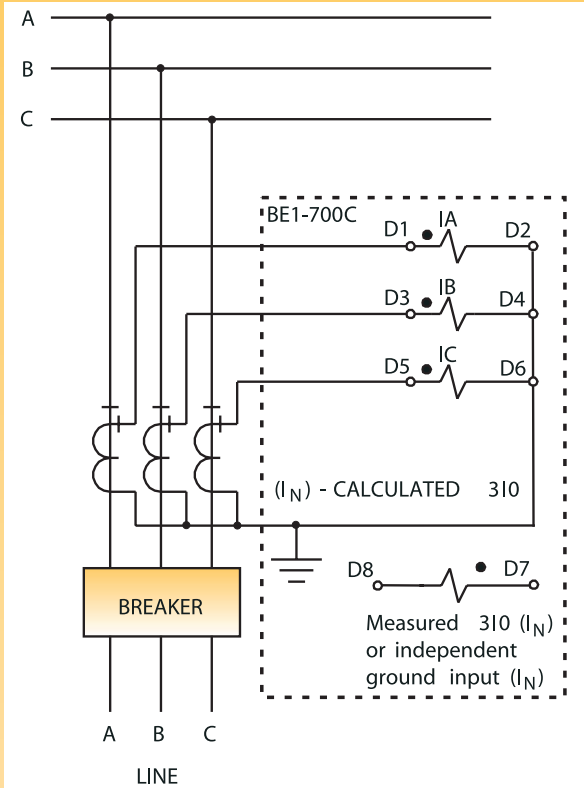


Figure 1A - Typical External Sensing Connections - Feeder Breaker Application

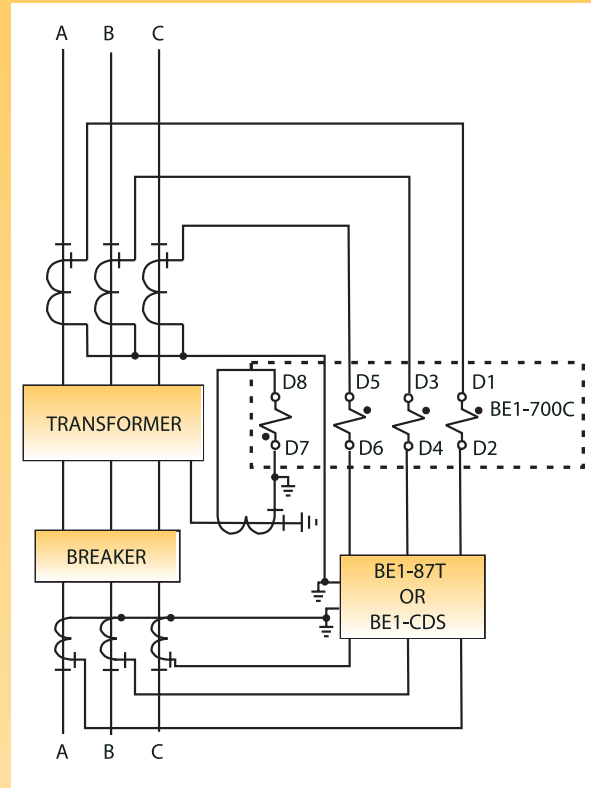


Figure 1B - Typical External Sensing Connections - Transformer Backup Application

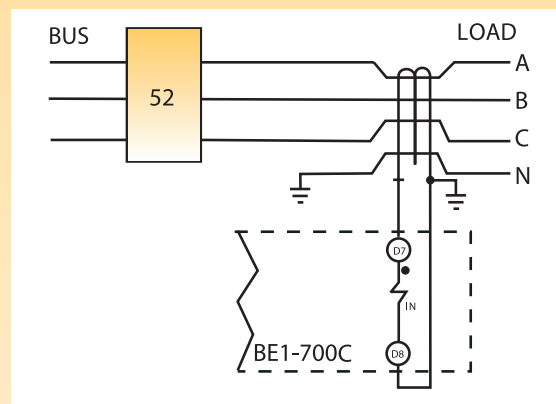


Figure 1C - Alternate Connections for IN



TYPICAL APPLICATION FOR THE BE1-700C WITH RECLOSING OPTION

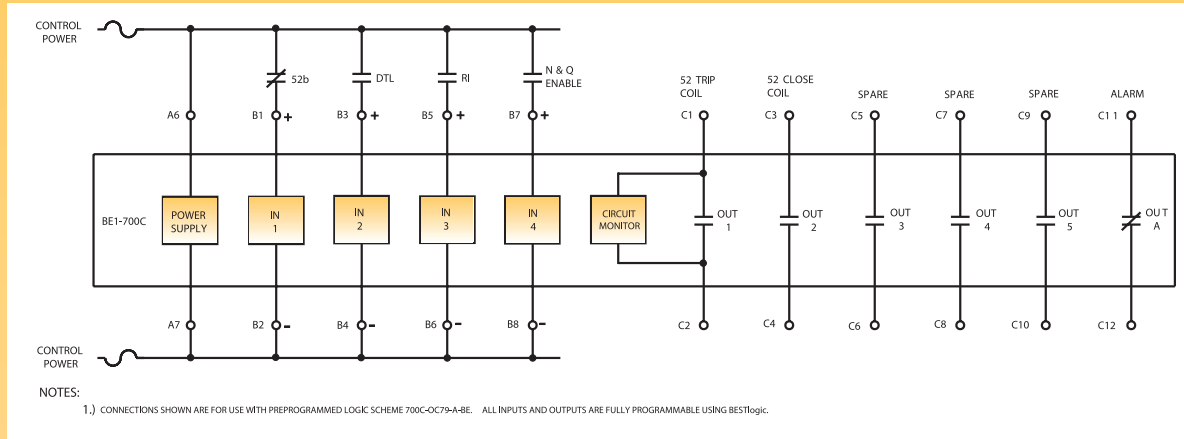
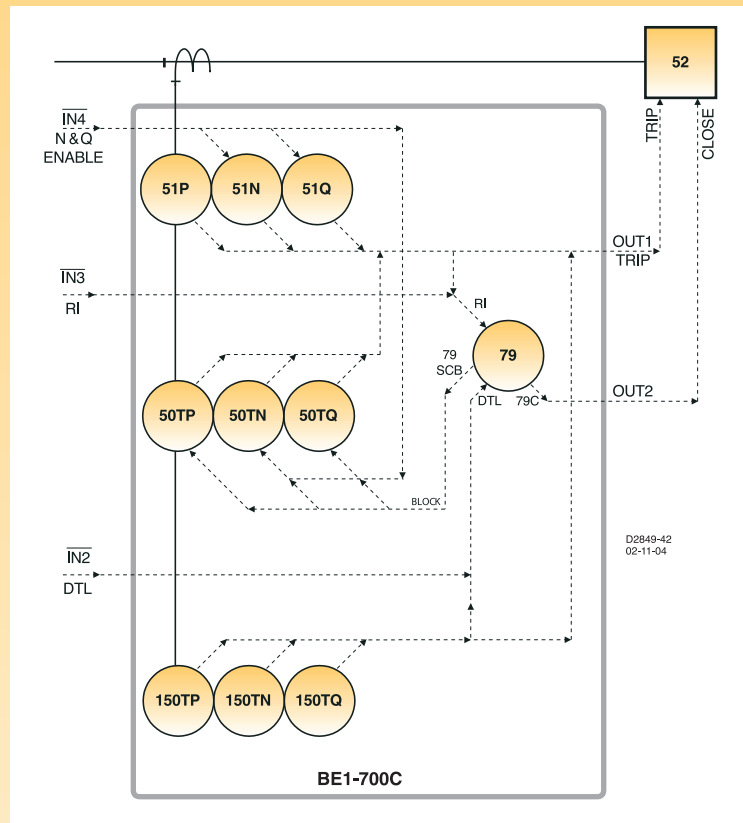


Figure 2 - Typical External Connections



Based upon pre-programmed logic 700C-OC79-A-BE.
Not all available protection and control functions are shown.

Figure 3 - Typical Application Single Line

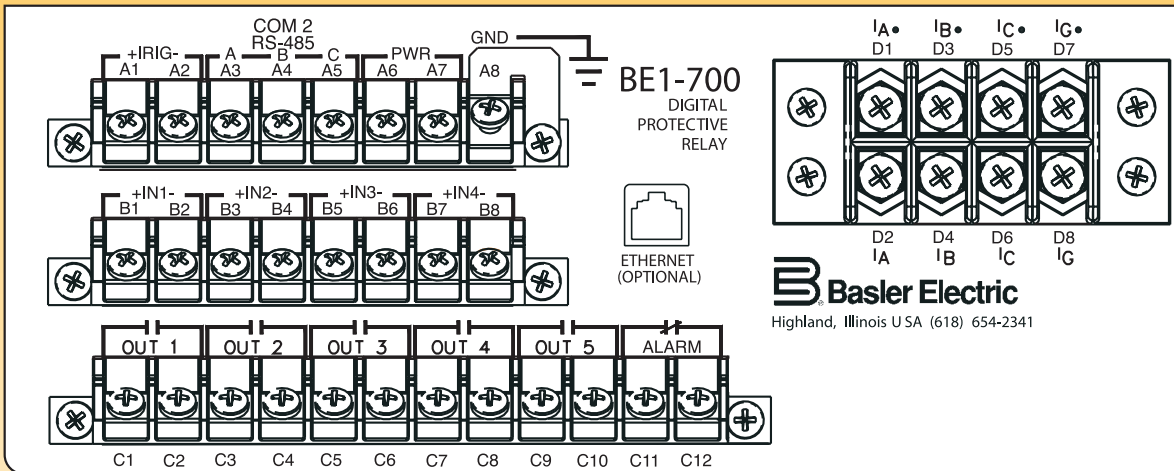


Figure 4 - BE1-700C Overcurrent Relay Rear Panel Connections

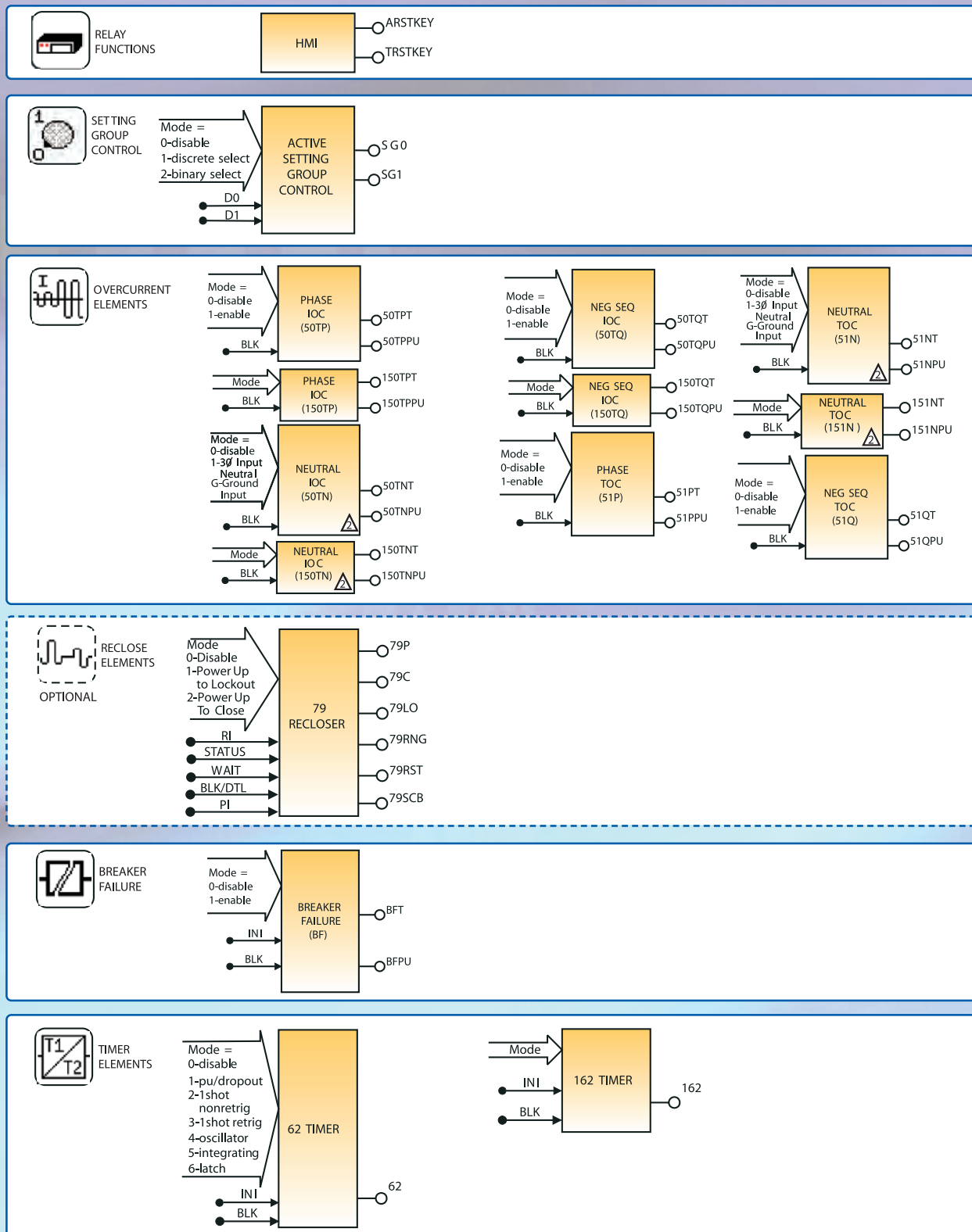


Figure 5 - BE1-700C Overcurrent Relay Rear Panel Connections

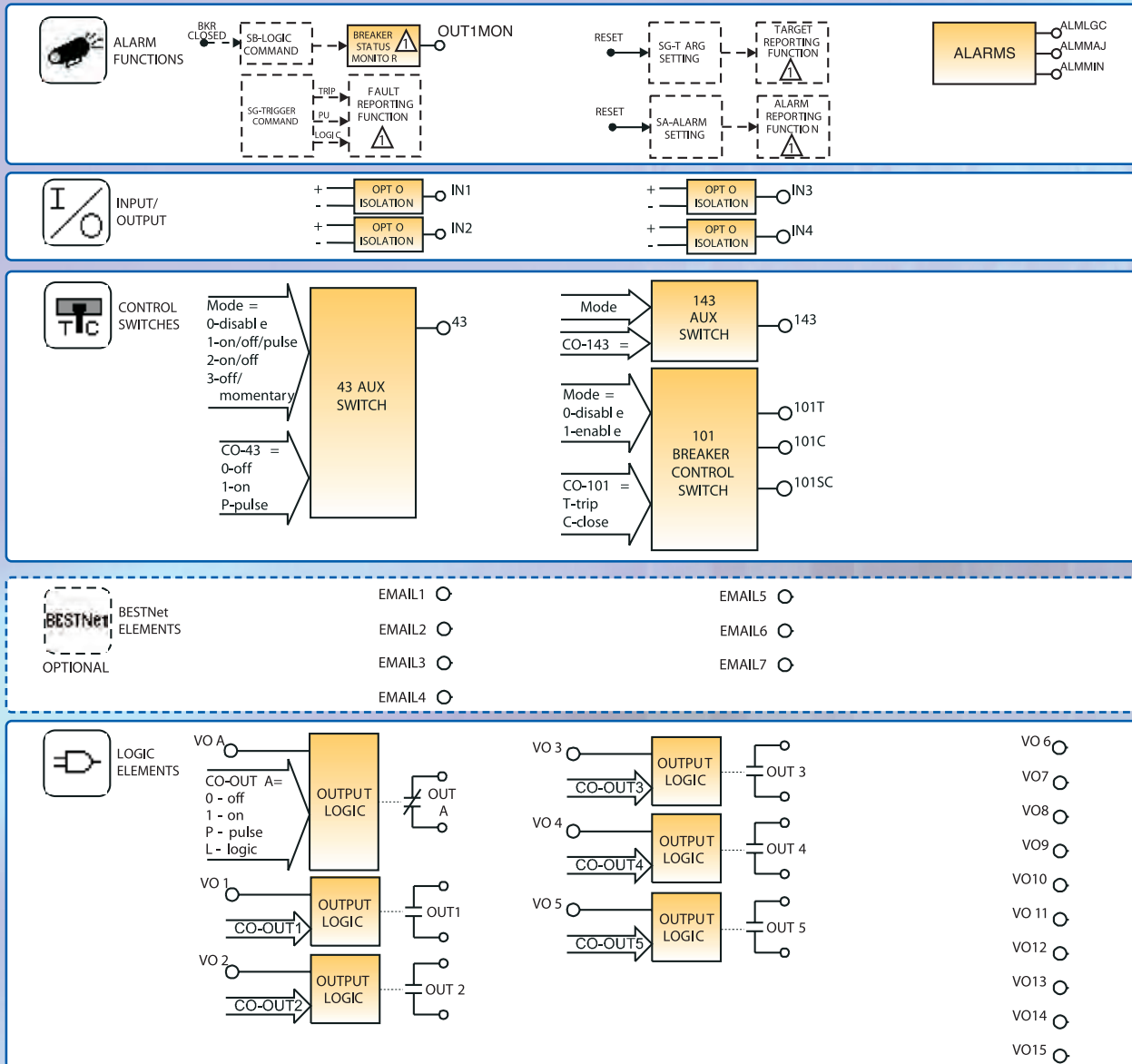


Figure 5A – BE1-700C BESTlogic Function Blocks



5 Amp CURRENT INPUTS

Continuous: 20 Amps
 One Sec. rating: 400 Amps
 Saturation limit: 150 Amps
 Max Burden: <10 milliohms

1 Amp CURRENT INPUTS

Continuous: 4 Amps
 One Sec. rating: 250 Amps
 Saturation limit: 30 Amps
 Max. Burden: <22 milliohms

A/D CONVERTER

Sampling Rate: 12/cycle

POWER SUPPLY

Option 1: 48VDC
 Option 2: 120VAC, 125VDC
 Option 3: 24VDC
 Option 4: 240VAC, 250VDC
 Burden: 6 W continuous, 8 W maximum with all outputs energized

OUTPUT CONTACTS

Make and carry: 30A (0.2sec)
 Continuous: 7A
 Break: 0.3A DC (L/R=0.04)
 @ 125Vdc or 250Vdc

CONTROL INPUTS

Wetting
 Voltage range: Same as control power supply option.

Power Supply Option	Turn-on Voltage Range (VDC)	Burden
1) 48 Vdc	26-38 V	13 k ohms
2) 120 Vac/125 Vdc	69-100 V	25 k ohms
3) 24 Vdc	5-8 V	7 k ohms
4) 240 Vac/250 Vdc	138-200 V	54 k ohms

Control inputs recognize both DC and AC voltages.

SERIAL COMMUNICATION PORTS

Response Time: <100mSec for metering and control functions
 Baud Rate: 300-19200
 Protocols: Front RS-232: ASCII
 Rear RS-485: ASCII standard, Modbus optional

ETHERNET PORT (OPTIONAL)

Type: 10/100 BaseT, RJ-45 connector
 Protocols: BESTNet or Modbus/TCP, see Page 4

GENERAL SPECIFICATIONS

MECHANICAL ENVIRONMENT

- Operating temperature range: -40°C to 70° C (-40°F to 158°F)*
- Storage temperature range: -40°C to 70°C (-40°F to 158°F)

* Display contrast may be impaired below -20°C.

CONFORMS TO STANDARDS:

- IEC 1000-4-2 (EN 61000-4-2) Electrostatic Discharge Immunity
- IEC 1000-4-3 (EN 61000-4-3) Radiated RF Immunity
- IEC 1000-4-4 (EN 61000-4-4) Electrical Fast Transient
- IEC 1000-4-5 (EN 61000-4-5) Surge-Lightning Strikes
- IEC 1000-4-6 (EN 61000-4-6) RF Conducted
- IEC 1000-4-8 (EN 61000-4-8) Power Freq. Magnetic Field
- IEC 1000-4-11 (EN 61000-4-11) Voltage Dips and Interruptions
- IEC 255-5: 1977 Insulation Tests For Relays
- IEC 255-11: 1979 Interruptions to and AC (Ripple) in DC
- IEC 255-22-1: 1988 1MHz Burst Disturbance
- IEC 255-22-2: 1996 Electrostatic Discharge
- IEC 255-22-3: 1989 Radiated Disturbance
- IEC 255-22-4: 1992 Fast Transient Disturbance
- IEEE C37.90.1: 2002 Surge Withstand Capability
- IEEE C37.90.1: 2002 Surge Withstand Capability
- IEEE C37.90.2: 1995 Radiated Electromagnetic Interference
- IEC 68-2-1: 1990 Test A. Cold
- IEC 68-2-2: 1974 Test B. Dry Heat
- IEC 68-2-3: 1969 Test Ca. Damp Heat
- IEC 68-2-30: 1980 Damp Heat Cyclic 12+12 Hour
- IEC 68-2-56: 1988 Damp Heat Steady State
- IEC 255-21-1 Vibration Tests
- IEC 255-21-2 Shock and Bump Tests

CERTIFICATIONS

UL recognized per Standard 508 and Standard CAN/CSA-C22-2 Number 14-M91, UL File Number E97033.
 GOST-R certified #POCC
 US.ME05.B03391.

CASE SIZE

10.5" wide, 4.46" high, 7.81" behind panel (.29" front projection)
 (266.7 mm wide, 113.23 mm high, 198.49 mm behind panel; 7.38 mm front projection)

SHIPPING WEIGHT

4.33 pounds (1.96 kg) maximum

WARRANTY

7 years



PERFORMANCE SPECIFICATIONS

INSTANTANEOUS OVERCURRENT WITH SETTABLE DELAY

(50TP, 150TP, 50TN, 150TN, 50TQ, 150TQ)

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 @ 5 x PU
3 cyc for Q @ 5 x PU

Delay Time:

Time Accuracy: ±0.5% or ±1/2 cyc for P&N
±0.5% or ±1 cyc for Q

TIME OVERCURRENT

(51P, 51N, 51Q, 151N)

Pickup: 5A CT: 0.50-16.0A
1A CT: 0.10-3.20A

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:

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

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

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.

BREAKER FAILURE

(BF)

Time: 50-999 mSec

Dropout: 5A CT: 0.5A
1A CT: 0.1A

Time Accuracy: ±0.5% or +1 1/4 cyc/ -1/2 cyc

GENERAL PURPOSE LOGIC TIMERS

(62, 162)

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 ±3/4 cyc

RECLOSER

(79) (Optional)

Mode: Power up to close, Power up to lockout
0 - 4

Reclose Shots:
Reclose, Reset,
Fail, Max.

Cycle Timers: 0.100 - 600 Sec.

Time Accuracy: ±0.5% or + 1 3/4 cyc/-0 cyc

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	1.000	0.028	29.000
F	0.0000	1.00000	0.000	0.0000	0.028	1.0000
46	*	0	0	2	0.028	100
P	0 to 600	0 to 25	0 to 1	.5 to 2.5	0.028	0 to 30

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 = Neg. Sequence Overcurrent

P = Programmable

GUIDEFORM SPECS

Available on e-catalog CD,
online at www.basler.com,
or from your representative

CURRENT PICKUP ACCURACY

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

SETTING GROUPS

Setting Groups: 2
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%

DEMANDS

(IA, IB, IC, IN, IQ)

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

BREAKER MONITORING

Duty Mode: I or I²
Duty Alarm Range: 0-100%
Op Counter Alarm Range: 0-99999
Trip Time Alarm Range: 20-1000 mSec



BE1-700C

Digital Overcurrent
Protective Relay

SAMPLE STYLE NUMBER

The style number identification chart below defines the electrical characteristics and operation features included in the BE1-700C relay. For example, if the style number were BE1-700 F0R4X5N, the device would have the following:

BE1-700 Digital Overcurrent Protective Relay

(F0) - 5 Amp Nominal Phase Current with 1 Amp Nominal Ground Input

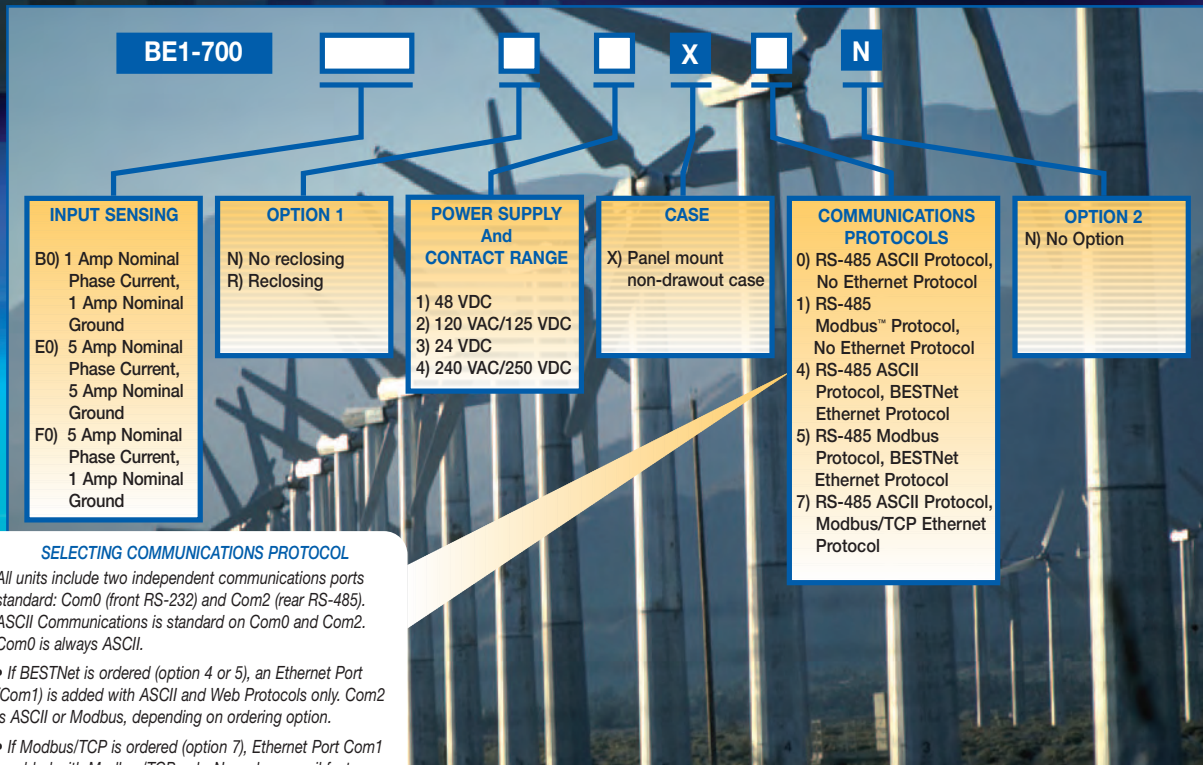
(R) - Reclosing

(4) - 240 VAC/250 VDC Power Supply, 240 VAC/250 VDC Contact Inputs

(X) - Panel mount, non-drawout case

(5) - Modbus on RS-485 port, BESTNet Ethernet protocol

(N) - Not applicable



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