GE
Grid Solutions

Multilin UR & UR^{Plus}

Proven, State-of-the-Art Protection & Control Systems

From the power plant to the power consumer, the Multilin™ UR & UR^{Plus} family of advanced protection and control relays provides one integrated platform that delivers leading edge protection, control, monitoring & metering solutions for critical power system applications. Featuring proven protection algorithms, expandable I/O, integrated monitoring & high accuracy metering capabilities with the latest in communications technologies, the Multilin UR & UR^{Plus} family of devices provides the situational awareness needed for a reliable, secure and efficient modern grid.

Key Benefits

- Modular construction: common hardware, reduced stock of pare parts, plug & play modules for maintenance cost savings and simplification (Multilin UR)
- Proven flexibility and customization capabilities make the Multilin UR/UR^{Plus} devices suitable to retrofit almost any kind of legacy P&C scheme
- Large HMI and annunciator panels provide local monitoring & control capabilities, and backup the substation HMI
- Phase measurement Unit (synchrophasors) according to IEEE® C37.118 (2011) and IEC® 61850-90-5 directly streamed from your protective device
- Embedded IEEE 1588 Time Synchronization Protocol support eliminates dedicated IRIG-B wiring requirements for P&C devices (Multilin UR)
- Advanced IEC 61850 Ed. 1 and Ed. 2 certified implementation, complete settings via SCL files and IEC 61850-9-2 process bus solution ensures interoperability, device managing optimization and reduced cost of ownership
- Routable GOOSE (R-GOOSE) enables customer to send GOOSE messages beyond the substation, which enables WAPC and more cost effective communication architectures for wide area applications
- Increased network availability via failover time reduced to zero through IEC® 62439-3 "PRP" support
- Supports IEEE C37.111-1999/2013, IEC 60255-24 Ed 2.0 COMTRADE standard

Applications

- Protection, control, monitoring and supervision of power assets across generation, transmission, distribution, substation and industrial systems
- Utility substation and industrial plant automation
- Digital fault recording and Sequence of Event (SOE) recording
- Predictive maintenance through data analysis and trending
- Synchrophasors based monitoring and control system with specialized PMU devices that support multiple feeders providing P&M class synchrophasors of voltage, current, and sequence components
- Complex protection & control and wide area monitoring solutions with complete diagnostic and automation capabilities (Multilin UR^{Plus})

imagination at work

Protection and Control

- Fast, segregated line current differential & distance protection functionality in one device
- Phase distance (5 zones) with independent settings for compensation
- Single-pole tripping, breaker-and-a-half with independent current source support
- Comprehensive generator protection with 100% stator and field ground fault detection
- Protection and control functionality in one box, reducing the number of devices
- Integrated large, full color display, for real-time visualization and control of the protected bay

Advanced Communications

- 3 independent Ethernet ports for simultaneous & dedicated network connections with IEEE 1588 support
- IEC 61850-9-2 process bus support

Cyber Security

- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)

Monitoring & Metering

- Advanced recording capabilities, configurable & extended waveform capture and data logger
- Fault locator fault reports & programmable
- Breaker condition monitoring including breaker arcing current (I2t), breaker re-strike and breaker flashover
- Metering: current, voltage, power factor, frequency, voltage & current harmonics, energy, demand, phasors, etc.

UR Technical Specifications

PROTECTION

100% STATOR GROUND

Operating quantity:	V_neutral_3rd/(V_neutral_3rd + V_zero_3rd)
Pickup level:	0.000 to 0.250 pu in steps of 0.001
Dropout level:	97 to 98% of pickup
Level accuracy:	±2% of reading from 1 to 120 V
Pickup delay:	0 to 600.00 s in steps of 0.01
3rd harmonic supervision level:	0.0010 to 0.1000 pu in steps of 0.0001
Time accuracy:	±3% or ±20 ms, whichever is greater
Operate time:	< 30 ms at 1.10 × Pickup at 60 Hz

ACCELERATION TIME

Acceleration current:	1.00 to 10.00 × FLA in steps of 0.01
Acceleration time:	0.00 to 180.00 s in steps of 0.01
Operating mode:	Definite Time, Adaptive

ACCIDENTAL ENERGIZATION

Operating condition:	Overcurrent
Arming condition:	Undervoltage and/or Machine Offline
Overcurrent:	
Pickup level:	0.02 to 3.000 pu in steps of 0.001
Dropout level:	97 to 98% of pickup
Level accuracy:	±0.5% of reading from 0.1 to 2.0 × CT rating
Undervoltage:	
Pickup level:	0.004 to 3.000 pu in steps of 0.001
Dropout level:	102 to 103% of pickup
Level accuracy:	±0.5% of reading 10 to 208 V
Operate Time:	< 30 ms at 1.10 × Pickup at 60 Hz

AUTORECLOSURE C60/D60/L90/L60

Two breakers applications
Single- and three-pole tripping schemes
Up to 4 reclose attempts before lockout
Selectable reclosing mode and breaker sequence

AUTORECLOSURE F60/F35/D30

Single breaker applications, 3-pole tripping schemes
Up to 4 reclose attempts before lockout
Independent dead time setting before each shot
Possibility of changing protection settings after each shot with FlexLogic.

AMP UNBALANCE

Avg and Full Load amps:	RMS
I_1 and 1_2 amps:	Phasor
Pickup level:	0.0 to 100.0% in steps of 0.1
Dropout level:	97 to 98% of pickup
Level accuracy:	±0.1
Pickup delay:	0.00 to 600.00 s in steps of 0.01
Reset delay:	0.00 to 600.00 s in steps of 0.01
Operate time:	< 20 ms at 1.10 × pickup at 60 Hz
Timing accuracy:	±3% or ±20 ms, whichever is greater

AUXILIARY OVERVOLTAGE

Pickup level:	0.004 to 3.000 pu in steps of 0.001
Dropout level:	97 to 98% of Pickup
Level accuracy:	±0.5% of reading from 10 to 208 V
Pickup delay:	0 to 600.00 s in steps of 0.01
Reset delay:	0 to 600.00 s in steps of 0.01
Timing accuracy:	±3% of operate time or ±4 ms (whichever is greater)
Operate time:	< 30 ms at 1.10 × pickup at 60 Hz

AUXILIARY UNDERVOLTAGE

Pickup level:	0.004 to 3.000 pu in steps of 0.001
Dropout level:	102 to 103% of pickup
Level accuracy:	±0.5% of reading from 10 to 208 V
Curve shapes:	GE IAV Inverse, Definite Time
Curve multiplier:	Time Dial = 0 to 600.00 in steps of 0.01
Timing accuracy:	±3% of operate time or ±4 ms (whichever is greater)

BREAKER ARCING CURRENT

Principle:	Accumulates breaker duty (I2t) and measures fault duration
Initiation:	Programmable per phase from any FlexLogic operand
Compensation for auxiliary relays:	0 to 65.535 s in steps of 0.001
Alarm threshold:	0 to 50000 kA2-cycle in steps of 1
Fault duration accuracy:	0.25 of a power cycle
Availability:	1 per CT bank with a minimum of 2

PROTECTION

BREAKER FAILURE

Mode:	1-pole, 3-pole
Current supervision:	phase, neutral current
Current supv. pickup:	0.02 to 30.000 pu in steps of 0.001
Current supv. dropout:	97 to 98% of pickup
Current supv. accuracy:	
0.1 to 2.0 × CT rating:	±0.75% of reading or ±2% of rated (whichever is greater)
above 2 × CT rating:	±2.5% of reading

BREAKER FLASHOVER

Operating quantity:	Phase current, voltage and voltage difference
Pickup level voltage:	0.02 to 1.500 pu in steps of 0.001
Dropout level voltage:	97 to 98% of pickup
Pickup level current:	0.004 to 1.500 pu in steps of 0.001
Dropout level current:	97 to 98% of pickup
Level accuracy:	±0.5% or ±0.1% of rated, whichever is greater
Pickup delay:	0 to 65.535 s in steps of 0.001
Time accuracy:	±3% or ±42 ms, whichever is greater
Operate time:	<42 ms at 1.10 × pickup at 60 Hz

BUS DIFFERENTIAL (87B)

Pickup level:	0.050 to 6.000 pu in steps of 0.001
Low slope:	15 to 100% in steps of 1
High slope:	50 to 100% in steps of 1
Low breakpoint:	1.00 to 30.00 pu in steps of 0.01
High breakpoint:	1.00 to 30.00 pu in steps of 0.01
High set level:	0.10 to 99.99 pu in steps of 0.01
Dropout level:	97 to 98% of Pickup
Level accuracy:	
0.1 to 2.0 × CT rating:	±0.5% of reading or ±1% of rated (whichever is greater)
>2.0 × CT rating	±1.5% of reading
Operating time:	one power system cycle (typical)

CT TROUBLE

Responding to:	Differential current
Pickup level:	0.020 to 2.000 pu in steps of 0.001
Pickup delay:	1.0 to 60.0 sec. in steps of 0.1
Time Accuracy:	±3% or ±40ms, whichever is greater
Availability:	1 per zone of protection (B90)

GENERATOR UNBALANCE

Gen. nominal current:	0.000 to 1.250 pu in steps of 0.001
Stages:	2 (I2t with linear reset and definite time)
Pickup level:	0.00 to 100.00% in steps of 0.01
Dropout level:	97 to 98% of pickup
Level accuracy:	
0.1 to 2 x CT rating:	±0.5% of reading or 1% of rated (whichever is greater)
> 2.0 x CT rating:	±1.5% of reading
Time dial (K-value):	0.00 to 100.00 in steps of 0.01
Pickup delay:	0.0 to 1000.0 s in steps of 0.1
Reset delay:	0.0 to 1000.0 s in steps of 0.1
Time accuracy:	±3% or ±20 ms, whichever is greater
Operate time:	< 50 ms at 60 Hz

GROUND DISTANCE

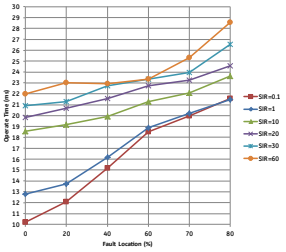
Characteristic:	Mho (memory polarized or offset) or Quad (memory polarized or non-directional), selectable individually per zone
Reactance polarization:	negative-sequence or zero-sequence current
Non-homogeneity angle:	-40 to 40° in steps of 1
Number of zones:	5
Directionality:	Forward, Reverse, or Non-Directional per zone
Reach (secondary W):	0.02 to 250.00 in steps of 0.01
Reach accuracy:	±5% including the effect of CVT transients up to an SIR of 30
Distance characteristic angle:	30 to 90° in steps of 1
Distance comparator limit angle:	30 to 90° in steps of 1
Directional supervision	
Characteristic angle:	30 to 90° in steps of 1
Limit angle:	30 to 90° in steps of 1
Zero-sequence compensation	
Z0/Z1 magnitude:	0.00 to 10.00 in steps of 0.01
Z0/Z1 angle:	-90 to 90° in steps of 1
Zero-sequence mutual compensation	
Z0M/Z1 magnitude:	0.00 to 7.00 in steps of 0.01
Z0M/Z1 angle:	-90 to 90° in steps of 1
Right blinder (Quad only):	
Reach:	0.02 to 500 in steps of 0.01
Characteristic angle:	60 to 90° in steps of 1
Left blinder (Quad only):	
Reach:	0.02 to 500 in steps of 0.01
Characteristic angle:	60 to 90° in steps of 1
Time delay:	0.000 to 65.535 s in steps of 0.001

PROTECTION

Timing accuracy:	±3% or 4 ms, whichever is greater
Current supervision:	
Level:	neutral current (3I_0)
Pickup:	0.050 to 30.000 pu in steps of 0.001
Dropout:	97 to 98%
Memory duration:	5 to 25 cycles in steps of 1
Voltage supervision pickup (series compensation applications):	0 to 5.000 pu in steps of 0.001
Operation time:	1 to 1.5 cycles (typical)
Reset time:	1 power cycle (typical)

GROUND DISTANCE OPERATING TIME CURVES

The operating times are response times of a microprocessor part of the relay. See output contacts specifications for estimation of the total response time for a particular application. The operating times are average times including variables such as fault inception angle or type of a voltage source (magnetic VTs and CVTs).



LINE CURRENT DIFFERENTIAL (87L)

Application:	2 or 3 terminal line, series compensated line, tapped line, with charging current compensation
Pickup current level:	0.20 to 4.00 pu in steps of 0.01
CT Tap (CT mismatch factor):	0.20 to 5.00 in steps of 0.01
Slope # 1:	1 to 50%
Slope # 2:	1 to 70%
Breakpoint between slopes:	0.0 to 20.0 pu in steps of 0.1
DTT:	Direct Transfer Trip (1 and 3 pole) remote L90
Operating Time:	1.0 to 1.5 power cycles duration
Asymmetrical channel delay compensation using GPS:	asymmetry up to 10ms

LINE CURRENT DIFFERENTIAL TRIP LOGIC

87L trip:	Adds security for trip decision; creates 1 and 3 pole trip logic
DTT:	Engaged Direct Transfer Trip (1 and 3 pole) from remote L90
DD:	Sensitive Disturbance Detector to detect fault occurrence
Stub bus protection:	Security for ring bus and 1½ breaker configurations
Open pole detector:	Security for sequential and evolving faults

LINE PICKUP

Phase IOC:	0.02 to 30.000 pu
Undervoltage pickup:	0.004 to 3.000 pu
Overvoltage delay:	0.000 to 65.535 s

LOAD ENCROACHMENT

Responds to:	Positive-sequence quantities
Minimum voltage:	0.004 to 3.000 pu in steps of 0.001
Reach (sec. W):	0.02 to 250.00 in steps of 0.01
Impedance accuracy:	±5%
Angle:	5 to 50° in steps of 1
Angle accuracy:	±2°
Pickup delay:	0 to 65.535 s in steps of 0.001
Reset delay:	0 to 65.535 s in steps of 0.001
Time accuracy:	±3% or ±4 ms, whichever is greater
Operate time:	< 30 ms at 60 Hz

LOSS OF EXCITATION

Operating condition:	Positive-sequence impedance
Characteristic:	2 independent offset mho circles
Center:	0.10 to 300.0 (sec.) in steps of 0.01
Radius:	0.10 to 300.0. (sec.) in steps of 0.01
Reach accuracy:	±3%
Undervoltage supervision	
Level:	0.000 to 1.250 pu in steps of 0.001
Accuracy:	± 0.5% of reading from 10 to 208V
Pickup delay:	0 to 65.535 s in steps of 0.001
Timing accuracy:	±3% or ±20 ms, whichever is greater
Operate time:	<50 ms

UR Technical Specifications

PROTECTION

MECHANICAL JAM

Operating condition:	Phase overcurrent
Arming condition:	Motor not starting
Pickup level:	1.00 to 10.00 × FLA in steps of 0.01
Dropout level:	97 to 98% of pickup
Level accuracy:	at 0.1 to 2.0 × CT: ±0.5% of reading
at > 2.0 × CT rating:	±1.5% of reading
Pickup delay:	0.10 to 600.00 s in steps of 0.01
Reset delay:	0.00 to 600.00 s in steps of 0.01
Time accuracy:	±3% or ±20 ms, whichever is greater

MOTOR START SUPERVISION

Maximum no. of starts:	1 to 16 in steps of 1
Monitored time interval:	1 to 300 minutes in steps of 1
Time between starts:	0 to 300 minutes in steps of 1
Restart delay:	0 to 50000seconds in steps of 1

NEGATIVE SEQUENCE DIRECTIONAL OC

Directionality:	Co-existing forward and reverse
Polarizing:	Voltage
Polarizing voltage:	V_2
Operating current:	I_2 or I_0
Level sensing:	
Zero-sequence:	|I_0| - K × |I_1|
Negative-sequence:	|I_2| - K × |I_1|
Restraint, K:	0.000 to 0.500 in steps of 0.001
Characteristic angle:	0 to 90° in steps of 1
Limit angle:	40 to 90° in steps of 1, independent for forward and reverse
Angle accuracy:	±2°
Offset impedance:	0.00 to 250.00W in steps of 0.01
Pickup level:	0.05 to 30.00 pu in steps of 0.01
Dropout level:	97 to 98%
Operation time:	< 16 ms at 3 × Pickup at 60 Hz

NEGATIVE SEQUENCE IOC

Current:	Phasor
Pickup level:	0.02 to 30.000 pu in steps of 0.001
Dropout level:	97 to 98% of Pickup
Level accuracy:	
0.1 to 2.0 × CT rating:	±0.5% of reading or ±1% of rated (whichever is greater)> 2.0 × CT rating: ±1.5% of reading
Overreach:	< 2%
Pickup delay:	0.00 to 600.00 s in steps of 0.01
Reset delay:	0.00 to 600.00 s in steps of 0.01
Operate time:	< 20 ms at 3 × Pickup at 60 Hz
Timing accuracy:	Operate at 1.5 × Pickup ±3% or ± 4 ms (whichever is greater)

NEGATIVE SEQUENCE OVERVOLTAGE

Pickup level:	0.004 to 1.250 pu in steps of 0.001
Dropout level:	97 to 98% of Pickup
Level accuracy:	±0.5% of reading from 10 to 208 V
Pickup delay:	0 to 600.00 s in steps of 0.01
Reset delay:	0 to 600.00 s in steps of 0.01
Time accuracy:	±3% or ±20 ms, whichever is greater
Operate time:	< 30 ms at 1.10 × Pickup at 60 Hz

NEGATIVE SEQUENCE TOC

Current:	Phasor
Pickup level:	0.02 to 30.000 pu in steps of 0.001
Dropout level:	97% to 98% of Pickup
Level accuracy:	±0.5% of reading or ±1% of rated (whichever is greater from 0.1 to 2.0 x CT rating ±1.5% of reading > 2.0 x CT rating
Curve shapes:	IEEE Moderately/Very/Extremely Inverse; IEC (and BS) A/B/C and Short Inverse; GE IAC Inverse, Short/Very/ Extremely Inverse; I2t; FlexCurves. (programmable); Definite Time (0.01 s base curve)
Curve multiplier (Time dial):	0.00 to 600.00 in steps of 0.01
Reset type:	Instantaneous/Timed (per IEEE) and L ear
Timing accuracy:	Operate at > 1.03 × Actual Pickup ±3.5% of operate time or ±½ cycle (whichever is greater)

NEUTRAL DIRECTIONAL OVERCURRENT

Directionality:	Co-existing forward and reverse
Polarizing:	Voltage, Current, Dual, Dual-I, Dual-V
Polarizing voltage:	V_0 or VX
Polarizing current:	IG
Operating current:	I_0
Level sensing:	3 × (|I_0| - K × |I_1|), IG
Restraint, K:	0.000 to 0.500 in steps of 0.001
Characteristic angle:	-90 to 90° in steps of 1
Limit angle:	40 to 90° in steps of 1, independent for forward and reverse
Angle accuracy:	±2°
Offset impedance:	0.00 to 250.00W in steps of 0.01
Pickup level:	0.05 to 30.00 pu in steps of 0.01
Dropout level:	97 to 98%
Operation time:	< 16 ms at 3 × Pickup at 60 Hz

NEUTRAL OVERVOLTAGE

Pickup level:	0.004 to 3.000 pu in steps of 0.001
Polarizing:	Voltage, Current, Dual, Dual-I, Dual-V
Level accuracy:	±0.5% of reading from 10 to 208 V
Pickup delay:	0.00 to 600.00 s in steps of 0.01
Reset delay:	0.00 to 600.00 s in steps of 0.01
Timing accuracy:	±3% or ±20 ms (whichever is greater)
Operate time:	< 30 ms at 1.10 × Pickup at 60 Hz

PROTECTION

OPEN POLE DETECTOR

Detects an open pole condition, monitoring breaker auxiliary contacts, the current in each phase and optional voltages on the line

Current pickup level:	0.02 to 30.000 pu in steps of 0.001
Line capacitive reactances (XC1, XC0):	300.0 to 9999.9 sec. W in steps of 0.1
Remote current pickup level:	0.02 to 30.000 pu in steps of 0.001
Current dropout level:	Pickup + 3%, not less than 0.05 pu

OVERFREQUENCY

Pickup level:	20.00 to 65.00 Hz in steps of 0.01
Dropout level:	Pickup - 0.03 Hz
Level accuracy:	±0.01 Hz
Time delay:	0 to 65.535 s in steps of 0.001
Timer accuracy:	±3% or 4 ms, whichever is greater

PHASE COMPARISON PROTECTION (87PC)

Signal Selection:	Mixed I_2 - K × I_1 (K=0.00 to 0.25 in steps of 0.01, or3I_0)
Angle Reference:	0 to 360° leading in steps of 1
Fault detector low:	
Instantaneous Overcurrent:	0.02 to 15.00 pu in steps of 0.01
$I_2 \times Z - V_2$:	0.005 to 15.00 pu in steps of 0.01
dI_2 / d_t:	0.01 to 5.00 pu in steps of 0.01
dI_1 / dt:	0.01 to 5.00 pu in steps of 0.01
Fault detector High:	
Instantaneous Overcurrent:	0.10 to 15.00 pu in steps of 0.01
$I_2 \times Z - V_2$:	0.005 to 15.00 pu in steps of 0.01
dI_2 / d_t:	0.01 to 5.00 pu in steps of 0.01
dI_1 / dt:	0.01 to 5.00 pu in steps of 0.01
Signal Symmetry Adjustment:	-0.5 to 5.0 ms in steps of 0.1
Channel Delay Adjustment:	0.000 to 30.00 ms in steps of 0.001
Channel Adjustments:	channel delay and signal symmetry compensation
Operate Time (Typical):	3/4 cycle for single phase comparison
Trip Security:	First coincidence or enhanced
Second Coincidence Timer:	10 to 200 ms in steps of 1
Enhanced Stability Angle:	40 to 180° in steps of 1

PHASE DIRECTIONAL OVERCURRENT

Relay connection:	90° (quadrature)
Quadrature voltage:	
ABC phase seq.:	phase A (V_{BC}), phase B (V_{CA}), phase C (V_{AB})
ACB phase seq.:	phase A (V_{CB}), phase B (V_{AC}), phase C (V_{BA})
Polarizing voltage threshold:	0.004 to 3.000 pu in steps of 0.001
Current sensitivity threshold:	0.05 pu
Characteristic angle:	0 to 359° in steps of 1
Angle accuracy:	±2°
Operation time: (FlexLogic elements):	
Tripping (reverse load, forward fault):	< 12 ms, typically
Blocking (forward load, reverse fault):	< 8 ms, typically

PHASE DISTANCE

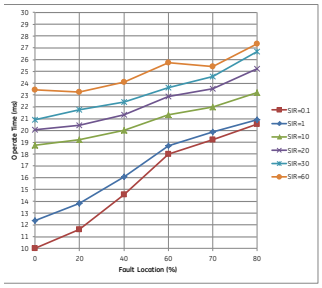
Characteristic:	Mho (memory polarized or offset) or Quad (memory polarized or non-directional), selectable individually per zone
Number of zones:	Up to 5
Directionality:	Forward, Reverse, or Non-Directional per zone
Reach (secondary W):	0.02 to 250.00 in steps of 0.01
Reach accuracy:	±5% including the effect of CVT transients up to an SIR of 30
Distance:	
Characteristic angle:	30 to 90° in steps of 1
Comparator limit angle:	30 to 90° in steps of 1
Directional supervision:	
Characteristic angle:	30 to 90° in steps of 1
Limit angle:	30 to 90° in steps of 1
Right blinder (Quad only):	
Reach:	0.02 to 500 in steps of 0.01
Characteristic angle:	60 to 90° in steps of 1
Left Blinder (Quad only):	
Reach:	0.02 to 500 in steps of 0.01
Characteristic angle:	60 to 90° in steps of 1
Time delay:	0.000 to 65.535 s in steps of 0.001
Timing accuracy:	±3% or 4 ms, whichever is greater
Current supervision:	
Level:	line-to-line current
Pickup:	0.050 to 30.000 pu in steps of 0.001
Dropout:	97 to 98%

PROTECTION

Memory duration:	5 to 25 cycles in steps of 1
VT location:	all delta-wye and wye-delta transformers
CT location:	all delta-wye and wye-delta transformers
Voltage supervision pickup (series compensation applications):	0 to 5.000 pu in steps of 0.001

PHASE DISTANCE OPERATING TIME CURVES

The operating times are response times of a microprocessor part of the relay. See output contacts specifications for estimation of the total response time for a particular application. The operating times are average times including variables such as fault inception angle or type of a voltage source (magnetic VTs and CVTs).



PHASE/NEUTRAL/GROUND IOC

Pickup level:	0.02 to 30.000 pu in steps of 0.001
Dropout level:	97 to 98% of pickup
Level accuracy:	
0.1 to 2.0 × CT rating:	±0.5% of reading or ±1% of rated (whichever is greater)
> 2.0 × CT rating:	±1.5% of reading
Overreach:	<2%
Pickup delay:	0.00 to 600.00 s in steps of 0.01
Reset delay:	0.00 to 600.00 s in steps of 0.01
Operate time:	<16ms at 3 × pickup at 60Hz (Phase/ Ground IOC) <20ms at 3 × pickup at 60Hz (Neutral IOC)
Timing accuracy:	Operate at 1.5 × Pickup ±3% or ±4 ms (whichever is greater)

PHASE/NEUTRAL/GROUND TOC

Current:	Phasor or RMS
Pickup level:	0.02 to 30.000 pu in steps of 0.001
Dropout level:	97% to 98% of Pickup
Level accuracy:	for 0.1 to 2.0 × CT: ±0.5% of reading or ±1% of rated (whichever is greater) for > 2.0 × CT: ±1.5% of reading > 2.0 × CT rating
Curve shapes:	IEEE Moderately/Very/Extremely Inverse; IEC (and BS) A/B/C and Short Inverse; GE IAC Inverse, Short/Very/ Extremely Inverse; I2t; FlexCurves. (programmable); Definite Time (0.01 s base curve)
Curve multiplier:	Time Dial = 0.00 to 600.00 in steps of 0.01
Reset type:	Instantaneous/Timed (per IEEE)
Timing accuracy:	Operate at > 1.03 × actual Pickup ±3.5% of operate time or ±½ cycle (whichever is greater)

PHASE OVERVOLTAGE

Voltage:	Phasor only
Pickup level:	0.004 to 3.000 pu in steps of 0.001
Dropout level:	97 to 98% of Pickup
Level accuracy:	±0.5% of reading from 10 to 208V
Pickup delay:	0.00 to 600.00 in steps of 0.01 s
Operate time:	< 30 ms at 1.10 × Pickup at 60 Hz
Timing accuracy:	±3% or ±4 ms (whichever is greater)

PHASE UNDERVOLTAGE

Voltage:	Phasor only
Pickup level:	0.004 to 3.000 pu in steps of 0.001
Dropout level:	102 to 103% of Pickup
Level accuracy:	±0.5% of reading from 10 to 208V
Curve shapes:	GE IAV Inverse; Definite Time (0.1s base curve)
Curve multiplier:	Time Dial = 0.00 to 600.00 in steps of 0.01
Timing accuracy:	Operate at < 0.90 × Pickup ±3.5% of operate time or ±4 ms (whichever is greater)

PILOT-AIDED SCHEMES

Direct Underreaching Transfer Trip (DUTT)
Permissive Underreaching Transfer Trip (PUTT)
Permissive Overreaching Transfer Trip (POTT)
Hybrid POTT Scheme
Directional Comparison Blocking Scheme
Customizable version of the POTT and DCB schemes (POTT1 and DCB1)

UR Technical Specifications

PROTECTION

POWER SWING DETECT

Functions:	Power swing block, Out-of-step trip
Characteristic:	Mho or Quad
Measured impedance:	Positive-sequence
Blocking / tripping mozes:	2-step or 3-step
Tripping mode:	Early or Delayed
Current supervision:	
Pickup level:	0.050 to 30.000 pu in steps of 0.001
Dropout level:	97 to 98% of Pickup
Fwd / reverse reach (sec. W):	0.10 to 500.00W in steps of 0.01
Left and right blinders (sec. W):	0.10 to 500.00W in steps of 0.01
Impedance accuracy:	±5%
Fwd / reverse angle impedances:	40 to 90° in steps of 1
Angle accuracy:	±2°
Characteristic limit angles:	40 to 140° in steps of 1
Timers:	0.000 to 65.535 s in steps of 0.001
Timing accuracy:	±3% or 4 ms, whichever is greater

RATE OF CHANGE OF FREQUENCY

df/dt trend:	increasing, decreasing, bi-directional
df/dt pickup level:	0.10 to 15.00 Hz/s in steps of 0.01
df/dt dropout level:	96% of pickup
df/dt level accuracy:	80 mHz/s or 3.5%, whichever is greater
Overvoltage supv.:	0.02 to 3.000 pu in steps of 0.001
Overcurrent supv.:	0.000 to 30.000 pu in steps of 0.001
Pickup delay:	0 to 65.535 s in steps of 0.001
Reset delay:	0 to 65.535 s in steps of 0.001
Time accuracy:	±3% or ±4 ms, whichever is greater
95% settling time for df/dt:	< 24 cycles
Operate time:	
at 2 × pickup:	12 cycles
at 3 × pickup:	8 cycles
at 5 × pickup:	6 cycles

RESTRICTED GROUND FAULT

Pickup:	0.000 to 30.000 pu in steps of 0.001
Dropout:	97 to 98% of Pickup
Slope:	0 to 100% in steps of 1%
Pickup delay:	0 to 600.00 s in steps of 0.01
Dropout delay:	0 to 600.00 s in steps of 0.01
Operate time:	< 1power system cycle

SENSITIVE DIRECTIONAL POWER

Measured power:	3-phase, true RMS
Number of stages:	2
Characteristic angle:	0 to 359° in steps of 1
Calibration angle:	0.00 to 0.95° in steps of 0.05
Minimum power:	-1.200 to 1.200 pu in steps of 0.001
Pickup level accuracy:	±1% or ±0.001 pu, whichever is greater
Hysteresis:	2% or 0.001 pu, whichever is greater
Pickup delay:	0 to 600.00 s in steps of 0.01
Time accuracy:	±3% or ±4 ms, whichever is greater
Operate time:	50 ms

SPLIT PHASE PROTECTION

Operating quantity:	split phast CT current biased by generator load current
Pickup level:	0.000 to 1.500 pu in steps of 0.001
Dropout level:	97 to 98% of pickup
Level accuracy:	±0.5% of reading or ±1% of rated
Pickup delay:	0.000 to 65.535 s in steps of 0.001
Time accuracy:	±3% of ± cycles, whichever is greater
Operate time:	< 5 cycles at 1.10 × pickup at 60Hz

STATOR DIFFERENTIAL

Pickup:	0.050 to 1.00 pu in steps of 0.01
Slope 1/2:	1 to 100% in steps of 1
Break 1:	1.00 to 1.50 pu in steps of 0.01
Break 2:	1.50 to 30.00 pu in steps of 0.01
Level accuracy:	±2%

SYNCHROCHECK

Max voltage difference:	0 to 400000 V in steps of 1
Max angle difference:	0 to 100° in steps of 1
Max freq. difference:	0.00 to 2.00 Hz in steps of 0.01
Hysteresis for max. freq. diff.:	0.00 to 0.10 Hz in steps of 0.01
Dead source function:	None, LV1 & DV2, DV1 & LV2, DV1 or DV2, DV1 xor DV2, DV1 & DV2 (L = Live, D = Dead)
Freq. Slip Maximun dF:	0.10 to 2.00 in steps of 0.01 Hz
Freq. Slip Minimun dF:	0.01 to 1.00 in steps of 0.01 Hz
Freq. Slip Close Breaker Time:	0.010 to 0.500 in steps of 0.001 s

PROTECTION

THERMAL MODEL

Thermal overload curves:	Standard curve, FlexCurve, voltage dependent curve
Standard Curve Time Multiplier:	0.00 to 600.00 in steps of 0.01
Thermal Overload Pickup:	pu = overload factor x FLA
Overload (OF):	1.00 to 1.50 in steps of 0.001
Standard Overload Curve:	

trip time =

$$\frac{TD \times 2.2116623}{0.02530337 \times \left(\frac{I_{motor}}{OF \times FLA}\right)^2 + 0.05054758 \times \frac{I_{motor}}{OF \times FLA}}$$

Motor Rated Voltage:	1 to 50000 V in steps of 1
Thermal Motor Biasing:	Current unbalance, RTDs
Thermal Model Update Rate:	1 power cycle
Stopped/Running Time Cool Constants:	1 to 65000 min. in steps of 1
Stopped/Running Time Cool Constants Decay:	Exponential
Hot/Cold Safe Stall Ratio:	0.01 to 1.00 in steps of 0.01
Current Accuracy:	Per phase current inputs
Current Source:	True RMS
Timing Accuracy	± 100 ms or ± 2% whichever is greater
Timing Accuracy for Voltage Dependent Overload:	± 100 ms or ± 4%, whichever is greater

THIRD HARMONIC NEUTRAL UNDERVOLTAGE

Operating quantity:	3rd harmonic of auxiliary undervoltage
Undervoltage:	
Pickup level:	0.001 to 3.000 pu in steps of 0.001
Dropout level:	102 to 103% of pickup
Accuracy:	±2% of reading from 1 to 120V
Power:	
Pickup level:	0.000 to 1.200 pu in steps of 0.001
Dropout level:	97 to 98% of pickup
Accuracy:	±5% or ±0.01 pu, whichever is greater
Undervoltage Inhibit	
Level:	0.000 to 3.000 pu in steps of 0.001 pu
Accuracy:	±0.5% of reading from 10 to 208V
Pickup delay:	0 to 600.00 s in steps of 0.01
Time accuracy:	±3% or ±20 ms, whichever is greater
Operate time:	< 30 ms at 1.10 × pickup at 60 Hz

TRANSFORMER AGING FACTOR

Operating quantity:	computed aging accelaration factor (pu)
Pickup level:	1 to 10 pu in steps of 0.1
Pickup delay:	0 to 30000 min. in steps of 1

TRANSFORMER INSTANTANEOUS DIFFERENTIAL

Pickup level:	2.00 to 30.00 pu in steps of 0.01
Dropout level:	97 to 98% of pickup
Level accuracy:	±0.5% of reading or ±1% of rated (whichever is greater)
Operate time:	< 20 ms at 3 × pickup at 60 Hz

TRANSFORMER HOTTEST-SPOT TEMPERATURE

Operating quantity:	computed temperature in °C
Pickup level:	50 to 300°C in steps of 1
Dropout level:	1°C below pickup
Pickup delay:	0 to 30000 min. in steps of 1

TRANSFORMER LOSS OF LIFE

Operating quantity:	computed accumulated transformer loss of life, in hours
Pickup level:	0 to 500000 hours in steps of 1

TRANSFORMER PERCENT DIFFERENTIAL

Characteristic:	Differential Restraint pre-set
Number of zones:	2
Minimum pickup:	0.05 to 1.00 pu in steps of 0.001
Slope 1 range:	15 to 100% in steps of 1%
Slope 2 range:	50 to 100% in steps of 1%
Kneepoint 1:	1.0 to 2.0 pu in steps of 0.0001
Kneepoint 2:	2.0 to 30.0 pu in steps of 0.0001
2nd harmonic inhibit level:	1.0 to 40.0% in steps of 0.1
2nd harmonic inhibit function:	Adaptive, Traditional, Disabled
2nd harmonic inhibit mode:	Per-phase, 2-out-of-3, Average
5th harmonic inhibit range:	1.0 to 40.0% in steps of 0.1
Operate times:	
Harmonic inhibits selected:	20 to 30 ms
No harmonic inhibits selected:	5 to 20 ms
Dropout level:	97 to 98% of pickup
Level accuracy:	±0.5% of reading or ±1% of rated (whichever is greater)

PROTECTION

TRIP OUTPUT

Collects trip and reclose input requests and issues outputs to control tripping and reclosing.

Communications timer delay:	0 to 65535 s in steps of 0.001
Evolving fault timer:	0.000 to 65.535 s in steps of 0.001
Timing accuracy:	±3% or 4 ms, whichever is greater

UNDERFREQUENCY

Minimum signal:	0.10 to 1.25 pu in steps of 0.01
Pickup level:	20.00 to 65.00 Hz in steps of 0.01
Dropout level:	Pickup + 0.03 Hz
Level accuracy:	±0.01 Hz
Time delay:	0 to 65.535 s in steps of 0.001
Timer accuracy:	±3% or 4 ms, whichever is greater

VOLTS PER HERTZ

Voltage:	Phasor only
Pickup level:	0.80 to 4.00 in steps of 0.01 pu V/Hz
Dropout level:	97 to 98% of Pickup
Level accuracy:	±0.02 pu
Timing curves:	Definite Time; Inverse A, B, and C, FlexCurves. A, B, C, and D
TD Multiplier:	0.05 to 600.00 s in steps of 0.01
Reset delay:	0.0 to 1000.0 s in steps of 0.1
Timing accuracy:	±3% or ± 4 ms (whichever is greater)

VT FUSE FAIL

Monitored parameters:	V_2, V_1, I_1

WATTMETRIC ZERO-SEQUENCE DIRECTIONAL

Measured Power	Zero-Sequence
Number of Elements:	2
Characteristic Angle:	0 to 360° in steps of 1
Minimum Power:	0.001 to 1.20pu in steps of 0.001
Pickup Level Accuracy:	±1% or ± 0.0025 pu, whichever is greater
Pickup Delay:	Definite time (0 to 600.00 s in steps of 0.01), inverse time, or FlexCurve
Inverse Time Multiplier:	0.01 to 2.00 s in steps of 0.01
Time Accuracy:	±3% or ±8 ms, whichever is greater
Operate Time:	<30 ms at 60 Hz

MONITORING

DATA LOGGER

Number of channels:	1 to 16
Parameters:	Any available analog actual value
Sampling rate:	15 to 3600000 ms in steps of 1
Trigger:	Any FlexLogic operand
Mode:	Continuous or Triggered
Storage capacity:	(NN is dependent on memory)
1-second rate:	01 channel for NN days 16 channels for NN days
60-minute rate:	01 channel for NN days 16 channels for NN days

EVENT RECORDER

Capacity:	1024 events
Time-tag:	to 1 microsecond
Triggers:	Any element pickup, dropout or operate Digital input change of state Digital output change of state Self-test events
Data storage:	In non-volatile memory

FAULT LOCATOR

Method:	Single-ended
Maximum accuracy if:	Fault resistance is zero or fault currents from all line terminals are in phase
Relay accuracy:	±1.5% (V > 10 V, I > 0.1 pu)
Worst-case accuracy:	VT%error + (user data) CT%error + (user data) ZLine%error + (user data) METHOD%error + (Chapter 6) RELAY ACCURACY%error + (1.5%)

HIGH-IMPEDANCE FAULT DETECTION (HIZ)

Detections:	Arc Suspected, Arc Detected, Downed Conductor, Phase Identification

OSCILLOGRAPHY

Maximum records:	64
Sampling rate:	64 samples per power cycle
Triggers:	Any element pickup, dropout or operate Digital input change of state Digital output change of state Any FlexLogic Operand FlexLogic Equation
Data:	AC input channels Element state Digital input state Digital output state
Data storage:	In non-volatile memory

USER-PROGRAMMABLE FAULT REPORT

Number of elements:	2
Pre-fault trigger:	any FlexLogic. operand
Fault trigger:	any FlexLogic. operand
Recorder quantities:	32 (any FlexAnalog value)

UR Technical Specifications

MONITORING

PHASOR MEASUREMENT UNIT

Output format:	per IEEE C37.118 standard
Number of channels:	14 synchrophasors, 16 analogs, 16 digitals
TVE (total vector error):	<1%
Triggering:	frequency, voltage, current, power, rate of change of frequency, user-defined
Reporting rate:	1, 2, 5, 10, 12, 15, 20, 25, 30, 50, 60 or 120 times per second
Number of clients:	One over TCP/IP port, two over UDP/IP ports
TAC ranges:	As indicated in appropriate specifications sections
Network reporting format:	16-bit integer or 32-bit IEEE floating point numbers
Network reporting style:	Rectangular (real and imaginary) or polar (magnitude and angle) coordinates
Filtering:	P and M class
Calibration:	Angle ±5°, magnitude +/-5% per phase
Compensation:	-180 to 180° in steps of 30° (current and voltage components)
Mode of operation:	Normal and test
PMU Recording:	46 configurable channels (14 syncrophasor, 16 digital, 16 analogs)

METERING

RMS CURRENT: PHASE, NEUTRAL, AND GROUND

Accuracy at:	
0.1 to 2.0 × CT rating:	±0.25% of reading or ±0.1% of rated (whichever is greater)
> 2.0 × CT rating:	±1.0% of reading

RMS VOLTAGE

Accuracy:	±0.5% of reading from 10 to 208 V

REAL POWER (WATTS)

Accuracy:	±1.0% of reading at -0.8 < PF < -1.0 and 0.8 < PF < 1.0

REACTIVE POWER (VARS)

Accuracy:	±1.0% of reading at -0.2 < PF < 0.2

APPARENT POWER (VA)

Accuracy:	±1.0% of reading

WATT-HOURS (POSITIVE AND NEGATIVE)

Accuracy:	±2.0% of reading
Range:	±0 to 2 × 109 MWh
Parameters:	3-phase only
Update rate:	50 ms

VAR-HOURS (POSITIVE AND NEGATIVE)

Accuracy:	±2.0% of reading
Range:	±0 to 2 × 109 Mvarh
Parameters:	3-phase only
Update rate:	50 ms

CURRENT HARMONICS

Harmonics:	2nd to 25th harmonic: per phase, displayed as a % of f1 (fundamental frequency phasor) THD: per phase, displayed as a % of f1
Accuracy:	
Harmonics:	1. f1 > 0.4pu: (0.20% + 0.035% / harmonic) of reading or 0.15% of 100%, whichever is greater 2. f1 < 0.4pu: as above plus %error of f1
THD:	1. f1 > 0.4pu: (0.25% + 0.035% / harmonic) of reading or 0.20% of 100%, whichever is greater 2. f1 < 0.4pu: as above plus %error of f1

DEMAND

Measurements:	Phases A, B, and C present and maximum measured currents 3-Phase Power (P, Q, and S) present and maximum measured currents
Accuracy:	±2.0%

FREQUENCY

Accuracy at	±0.01 Hz (when voltage signal is used for frequency measurement)
V = 0.8 to 1.2 pu:	±0.05 Hz
I = 0.1 to 0.25 pu:	±0.02 Hz (when current signal is used for frequency measurement)
I > 0.25 pu:	

VOLTAGE HARMONICS

Harmonics:	2nd to 25th harmonic: per phase, displayed as a % of f1 (fundamental frequency phasor) THD: per phase, displayed as a % of f1
Accuracy:	
Harmonics:	1. f1 > 0.4pu: (0.20% + 0.035% / harmonic) of reading or 0.15% of 100%, whichever is greater 2. f1 < 0.4pu: as above plus %error of f1
THD:	1. f1 > 0.4pu: (0.25% + 0.035% / harmonic) of reading or 0.20% of 100%, whichever is greater 2. f1 < 0.4pu: as above plus %error of f1

USER-PROGRAMMABLE ELEMENTS

CONTROL PUSHBUTTONS

Number of pushbuttons:	3 (standard), 16 (UR Enhanced HMI) or 8 plus 10 soft pushbuttons (UR color HMI)
Operation:	drive FlexLogic. operands

FLEXCURVES

Number:	4 (A through D)
Reset points:	40 (0 through 1 of pickup)
Operate points:	80 (1 through 20 of pickup)
Time delay:	0 to 65535 ms in steps of 1

FLEXLOGIC

Programming language:	Reverse Polish Notation with graphical visualization (keypad programmable)
Lines of code:	1024
Internal variables:	64
Supported operations:	NOT, XOR, OR (2 to 16 inputs), AND (2 to 16 inputs), NOR (2 to 16 inputs), NAND (2 to 16 inputs), Latch (Reset Dominant), Edge Detectors, Timers
Inputs:	any logical variable, contact, or virtual input
Number of timers:	32
Pickup delay:	0 to 60000 (ms, sec., min.) in steps of 1
Dropout delay:	0 to 60000 (ms, sec., min.) in steps of 1

FLEXELEMENTS

Number of elements:	8 or 16
Operating signal:	any analog actual value, or two values in Differential mode
Operating signal mode:	Signed or Absolute Value
Operating mode:	Level, Delta
Comparator direction:	Over, Under
Pickup Level:	-30.000 to 30.000 pu in steps of 0.001
Hysteresis:	0.1 to 50.0% in steps of 0.1
Delta dt:	20 ms to 60 days
Pickup & dropout delay:	0.000 to 65.535 s in steps of 0.001

FLEXSTATES

Number:	up to 256 logical variables grouped under 16 Modbus addresses
Programmability:	any logical variable, contact, or virtual input

LED TEST

Initiation:	from any digital input or user-programmable condition
Number of tests:	3, interruptible at any time
Duration of full test:	approximately 3 minutes
Test sequence 1:	all LEDs on
Test sequence 2:	all LEDs off, one LED at a time on for 1 s
Test sequence 3:	all LEDs on, one LED at a time off for 1 s

NON-VOLATILE LATCHES

Type:	Set-dominant or Reset-dominant
Number:	16 (individually programmed)
Output:	Stored in non-volatile memory
Execution sequence:	As input prior to protection, control, and FlexLogic.

SELECTOR SWITCH

Number of elements:	2
Upper position limit:	1 to 7 in steps of 1
Selecting mode:	Time-out or Acknowledge
Time-out timer:	3.0 to 60.0 s in steps of 0.1
Control inputs:	step-up and 3-bit
Power-up mode:	restore from non-volatile memory or synchronize to a 3-bit control input

USER-DEFINABLE DISPLAYS

Number of displays:	16
Lines of display:	2 × 20 alphanumeric characters
Parameters:	up to 5, any Modbus register addresses
Invoking and scrolling:	keypad, or any user-programmable condition, including pushbuttons

USER-PROGRAMMABLE LEDS

Number:	48 plus Trip and Alarm (UR Enhanced HMI), 8 plus Trip and Alarm (UR Color HMI)
Programmability:	from any logical variable, contact, or virtual input
Reset mode:	Self-reset or Latched

USER-PROGRAMMABLE PUSHBUTTONS (OPTIONAL)

Number of pushbuttons:	13 (standard), 16 (UR Enhanced HMI) or 8 plus 10 soft pushbuttons (UR color HMI)
Mode:	Self-Reset, Latched
Display message:	2 lines of 20 characters each

8-BIT SWITCH

Number of elements:	6
Input signals:	two 8-bit integers via FlexLogic operands
Control:	any FlexLogic operand
Response time:	< 8 ms at 60 Hz, < 10 ms at 50 Hz

INPUTS

AC CURRENT

CT rated primary:	1 to 50000 A
CT rated secondary:	1 A or 5 A by connection
Nominal frequency:	20 to 65 Hz
Relay burden:	< 0.2 VA at rated secondary
Conversion range:	
Standard CT:	0.02 to 46 × CT rating RMS symmetrical
Sensitive Ground/HI-Z CT module:	0.002 to 4.6 × CT rating RMS symmetrical
Current withstand:	20 ms at 250 times rated 1 sec. at 100 times rated continuous at 3 times rated continuous 4xInom; URs equipped with 24 CT inputs have a maximum operating temp. of 50°C

AC VOLTAGE

VT rated secondary:	50.0 to 240.0 V
VT ratio:	1.00 to 24000.00
Nominal frequency:	20 to 65 Hz For the L90, the nominal system frequency should be chosen as 50 Hz or 60 Hz only.
Relay burden:	< 0.25 VA at 120 V
Conversion range:	1 to 275 V
Voltage withstand:	continuous at 260 V to neutral 1 min./hr at 420 V to neutral

CONTACT INPUTS

Dry contacts:	1000 Ω maximum
Wet contacts:	300 V DC maximum
Selectable thresholds:	17 V, 33 V, 84 V, 166 V
Tolerance:	±10%
Contacts Per Common Return:	4
Recognition time:	< 1 ms
Debounce timer:	0.0 to 16.0 ms in steps of 0.5
Continuous Current Draw:	3mA (when energized)

CONTACT INPUTS WITH AUTO-BURNISHING

Dry contacts:	1000 Ω maximum
Wet contacts:	300 V DC maximum
Selectable thresholds:	17 V, 33 V, 84 V, 166 V
Tolerance:	±10%
Contacts Per Common Return:	2
Recognition time:	< 1 ms
Debounce timer:	0.0 to 16.0 ms in steps of 0.5
Continuous Current Draw:	3mA (when energized)
Auto-Burnish Impulse Current:	50 to 70 mA
Duration of Auto-Burnish Impulse:	25 to 50 ms

DCMA INPUTS

Current input (mA DC):	0 to -1, 0 to +1, -1 to +1, 0 to 5, 0 to 10, 0 to 20, 4 to 20 (programmable)
Input impedance:	379 ±10%
Conversion range:	-1 to + 20 mA DC
Accuracy:	±0.2% of full scale
Type:	Passive

DIRECT INPUTS

Number of input points:	32
No. of remote devices:	16
Default states on loss of comms.:	On, Off, Latest/Off, Latest/On
Ring configuration:	Yes, No
Data rate:	64 or 128 kbps
CRC:	32-bit
CRC alarm:	
Responding to:	Rate of messages failing the CRC
Monitoring message count:	10 to 10000 in steps of 1
Alarm threshold:	1 to 1000 in steps of 1
Unreturned message alarm:	
Responding to:	Rate of unreturned messages in the ring configuration
Monitoring message count:	10 to 10000 in steps of 1
Alarm threshold:	1 to 1000 in steps of 1

IRIG-B INPUT

Amplitude modulation:	1 to 10 V pk-pk
DC shift:	TTL
Input impedance:	22 kW
Isolation:	2 kV

REMOTE INPUTS (IEC 61850 GSSE)

Number of input points:	32, configured from 64 incoming bit pairs
Number of remote devices:	16
Default states on loss of comms.:	On, Off, Latest/Off, Latest/On

RTD INPUTS

Types (3-wire):	100 Ω Platinum, 100 Ω & 120 Ω Nickel, 10 Ω Copper
Sensing current:	5 mA
Range:	-50 to +250°C
Accuracy:	±2°C
Isolation:	36 V pk-pk

UR Technical Specifications

OUTPUTS

CONTROL POWER EXTERNAL OUTPUT (FOR DRY CONTACT INPUT)

Capacity: 100 mA DC at 48 V DC
Isolation: ±300 Vpk

DCMA OUTPUTS

Range: -1 to 1 mA, 0 to 1 mA, 4 to 20 mA
Max. load resistance: 12 k for -1 to 1 mA range
12 k for 0 to 1 mA range
600 for 4 to 20 mA range
Accuracy:
±0.75% of full-scale for 0 to 1 mA range
±0.5% of full-scale for -1 to 1 mA range
±0.75% of full-scale for 0 to 20 mA range
99% Settling time to a step change: 100 ms
Isolation: 1.5 kV
Driving signal: any FlexAnalog quantity
Upper & lower limit for the driving signal: -90 to 90 pu in steps of 0.001

DIRECT OUTPUTS

Output points: 32

FORM-A CURRENT MONITOR

Threshold current: approx. 80 to 100 mA

FORM-A RELAY

Make & carry for 0.2s: 30 A as per ANSI C37.90
Carry continuous: 6 A
Break at L/R of 40 ms: 1 A DC max. at 24 V
0.5 A DC max. at 48 V
0.3 A DC max. at 125 V
0.2 A DC max. at 250 V
Operate time: < 4 ms
Contact material: Silver alloy

FORM-A VOLTAGE MONITOR

Applicable voltage: approx. 15 to 250 V DC
Trickle current: approx. 1 to 2.5 mA

INPUT VOLTAGE	IMPEDANCE	
	2W RESISTOR	1W RESISTOR
250 V DC	20 K	50K
120 V DC	5 K	2 K
48 V DC	2 K	2 K
24 V DC	2 K	2 K

FORM-C AND CRITICAL FAILURE RELAY

Make & carry for 0.2 s: 30 A
Carry continuous: 8 A
Break at L/R of 40 ms: 0.25 A DC max. at 48 V
0.10 A DC max. at 125 V
Operate time: < 8 ms
Contact material: Silver alloy

FAST FORM-C RELAY

Make & carry: 0.1 A max. (resistive load)
Minimum load impedance:
Operate time: < 0.6 ms
Internal Limiting Resistor: 100, 2

IRIG-B OUTPUT

Amplitude: 10 V peak-peak RS485 level
Maximum load: 100 ohms
Time delay: 1 ms for AM input
40 µs for DC-shift input
Isolation: 2 kV

LATCHING RELAY

Make & carry for 0.2 s: 30 A as per ANSI C37.90
Carry continuous: 6 A
Break at L/R of 40 ms: 0.25 A DC max.
Operate time: < 4 ms
Contact material: Silver alloy
Control: separate operate and reset inputs
Control mode: operate-dominant or reset-dominant

REMOTE OUTPUTS (IEC 61850 GSSE)

Standard output points: 32
User output points: 32

SOLID-STATE OUTPUT RELAY

Operate & release time: <100 µs
Maximum voltage: 265 V DC
Maximum continuous current: 5 A at 45°C; 4 A at 65°C
Make & carry for 0.2 s: as per ANSI C37.90
For 0.3s: 300 A
Breaking capacity:

	IEC 647-5/UL508	UTILITY APPLICATION (AUTORECLOSE SCHEME)	INDUSTRIAL APPLICATION
Operations/ interval	5000 ops 1 s-On, 9 s-Off	5 ops/ 2 s-On, 0.2 s-Off within 1 minute	10000 ops/ 0.2 s-On, 30 s-Off
	1000 ops 0.5 s-On, 0.5 s-Of		
Break capability (0 to 250 VDC)	3.2 A L/R = 10 ms	10 A L/R = 40 ms	10 A L/R = 40 ms
	1.6 A L/R = 20 ms		
	0.8 A L/R = 40 ms		

COMMUNICATIONS

RS232

Front port: 19.2 kbps, Modbus® RTU, DNP 3.0

RS485

1 or 2 rear ports: Up to 115 kbps, Modbus® RTU, DNP 3.0 isolated together at 36 Vpk
Typical distance: 1200 m
Isolation: 2 kV

ETHERNET PORT

10Base-F: 820 nm, multi-mode, supports half-duplex/full-duplex fiber optic with ST connector
Redundant 10Base-F: 820 nm, multi-mode, half-duplex/ full-duplex fiber optic with ST connector
10Base-T: RJ45 connector
Power budget: 10 dB
Max optical input power: -7.6 dBm
Max optical output power: -20 dBm
Receiver sensitivity: -30 dBm
Typical distance: 1.65 km
SNTP Clock (redundant) synchronization error: <10 ms (typical)

PROTOCOLS

	RS232	RS485	10BaseF	10BaseT	100BaseT
IEC 61850			•	•	•
DNP 3.0	•	•	•	•	•
Modbus	•	•	•	•	•
IEC104			•	•	•
EGD			•	•	•

INTER-RELAY COMMUNICATIONS

SHIELDED TWISTED-PAIR INTERFACE OPTIONS

INTERFACE TYPE	TYPICAL DISTANCE
RS422	1200m
G.703	100m

* NOTE: RS422 distance is based on transmitter power and does not take into consideration the clock source provided by the user.

LINK POWER BUDGET

EMITTER, FIBER TYPE	TRANSMIT POWER	RECEIVED SENSITIVITY	POWER BUDGET
820nm LED Multimode	-20dBm	-30dBm	10dB
1300 nm LED Multimode	-21dBm	-30dBm	9dB
1300 nm ELED Multimode	-21dBm	-30dBm	9dB
1300 nm Laser Singlemode	-1dBm	-30dBm	29dB
1550 nm Laser Singlemode	+5dBm	-30dBm	35dB

* NOTE: These power budgets are calculated from the manufacturers' worst-case transmitter power and worst-case receiver sensitivity.

MAXIMUM OPTICAL INPUT POWER

EMITTED, FIBER TYPE	MAX. OPTICAL INPUT POWER
820 nm LED, Multimode	-7.6 dBm
1300 nm LED, Multimode	-11 dBm
1300 nm ELED, Singlemode	-14 dBm
1300 nm Laser, Singlemode	-14 dBm
1500 nm Laser, Singlemode	-14 dBm

TYPICAL LINK DISTANCE

EMITTED TYPE	FIBER TYPE	CONNECTOR TYPE	TYPICAL DISTANCE
820 nm LED	Multimode	-7.6 dBm	1.65 km
1300 nm LED	Multimode	-11 dBm	3.8 km
1300 nm ELED	Singlemode	-14 dBm	11.4 km
1300 nm Laser	Singlemode	-14 dBm	64 km
1500 nm Laser	Singlemode	-14 dBm	105 km

INTER-RELAY COMMUNICATIONS

* Note: Typical distances listed are based on the following assumptions for system loss. Actual losses will vary from one installation to another, the distance covered by your system may vary.

CONNECTOR LOSSES (TOTAL OF BOTH ENDS)

ST connector 2dB

FIBER LOSSES

820 nm multimode 3 dB/km
1300 nm mulimode 1 dB/km
1300 nm singlemode 0.35 dB/km
1550 nm singlemode 0.25 dB/km
Splice losses: One splice every 2 km, at 0.05 dB loss per splice

SYSTEM MARGIN

3 dB additional loss added to calculations to compensate for all other losses.

Compensate difference in transmitting and receiving (channel asymmetry) channel delays using GPS satellite clock: 10 ms

POWER SUPPLY

LOW RANGE

Nominal DC voltage: 24 to 48 V at 3 A
Min/max DC voltage: 20 / 60 V
*** NOTE:** Low range is DC only.

HIGH RANGE

Nominal DC voltage: 125 to 250 V at 0.7 A
Min/max DC voltage: 88 / 300 V
Nominal AC voltage: 100 to 240 V at 50/60 Hz, 0.7 A
Min/max AC voltage: 88 / 265 V at 25 to 100 Hz

ALL RANGES

Volt withstand: 2 × Highest Nominal Voltage for 10 ms
Voltage loss hold-up: 50 ms duration at nominal
Power consumption: Typical = 15 VA; Max. = 30 VA

INTERNAL FUSE

RATINGS
Low range power supply: 8 A / 250 V
High range power supply: 4 A / 250 V
INTERRUPTING CAPACITY
AC: 100 000 A RMS symmetrical
DC: 10 000 A
Hold up time: 200 ms

TYPE TESTS

Electrical fast transient: ANSI/IEEE C37.90.1
IEC 61000-4-4
IEC 60255-22-4
Oscillatory transient: ANSI/IEEE C37.90.1
IEC 61000-4-12
Insulation resistance: IEC 60255-5
Dielectric strength: IEC 60255-6
ANSI/IEEE C37.90
Electrostatic discharge: EN 61000-4-2
Surge immunity: EN 61000-4-5
RFI susceptibility: ANSI/IEEE C37.90.2
IEC 61000-4-3
IEC 60255-22-3
Ontario Hydro C-5047-77
Conducted RFI: IEC 61000-4-6
Voltage dips/interruptions/variations:
IEC 61000-4-11
IEC 60255-11
Power frequency magnetic field immunity:
IEC 61000-4-8
Vibration test (sinusoidal): IEC 60255-21-1
Shock and bump: IEC 60255-21-2
*** NOTE:** Type test report available upon request.

PRODUCTION TESTS

THERMAL

Products go through an environmental test based upon an accepted quality level (AQL) sampling process

ENVIRONMENTAL

OPERATING TEMPERATURES

Cold: IEC 60028-2-1, 16 h at -40°C
Dry Heat: IEC 60028-2-2, 16 h at +85°C

OTHER

Humidity(noncondensing): IEC 60068-2-30, 95%, Variant 1,6days.
Altitude: Up to 2000 m
Installation Category: II

APPROVALS

UL Listed for the USA and Canada
Manufactured under an ISO9000 registered system.
CE LVD 73/23/EEC: IEC 1010-1
EMC 81/336/EEC: EN 50081-2, EN 50082-2

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