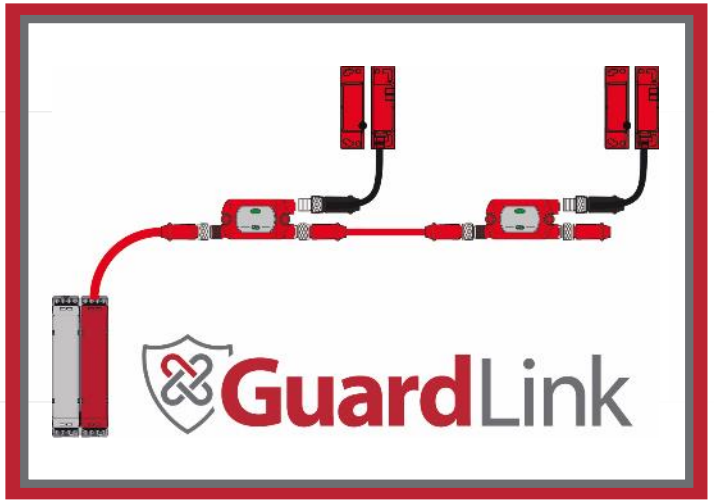
LISTEN. THINK. SOLVE.®

GuardLink™

Enabling Smart Safety Devices in The Connected Enterprise



PUBLIC

Allen-Bradley • Rockwell Software

Rockwell Automation

GuardLink™ System

Overview, Features and Benefits

GuardLink™

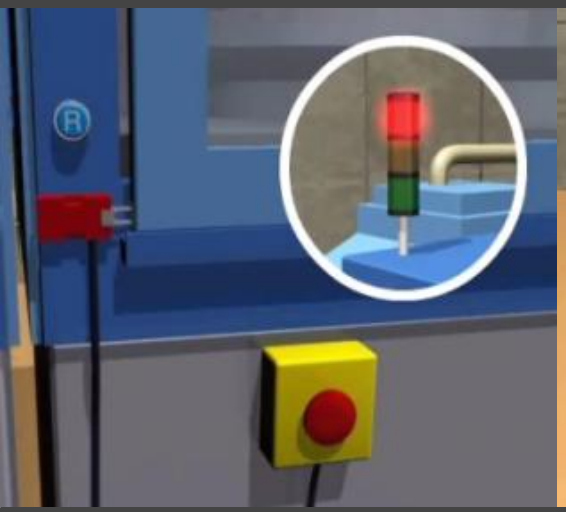
- SMART: Provides access to diagnostic data when safety function is in a safe state
- SIMPLE: No configuration required and devices use standard 4 wire cables with M12 connectors
- SAFE: Daisy chain up to 32 devices with no loss of Safety rating (up to PLe)

Series connection of devices typically reduces the granularity of the diagnostics, leading to unnecessary machine downtime – not so with GuardLink

Diagnostics are critical for identifying the location and reason for the demand on the safety system as well as guiding operators through a quick recovery

Common Use Case

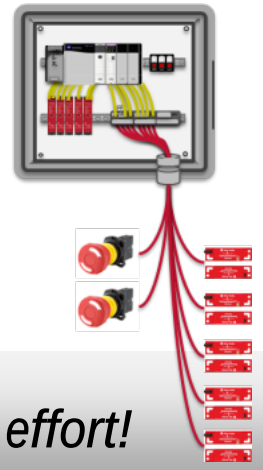
Locate demand and faults within series connections

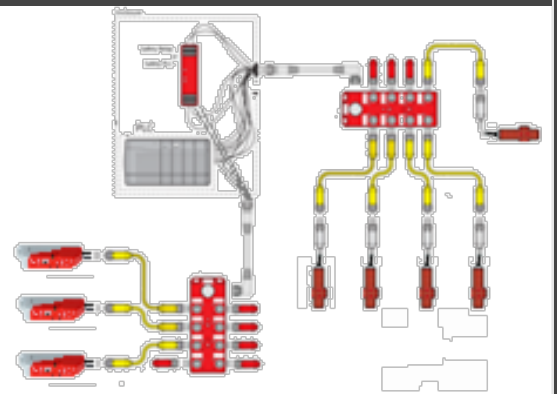


How can we get data from switch with a demand or fault?

Current solutions

- Increase system cost and wiring by having each safety device connect to an input of the safety controller
- Use distribution blocks or terminal blocks to connect the safety signal in series and pull out individual auxiliaries from the device so they can be connected to a controller





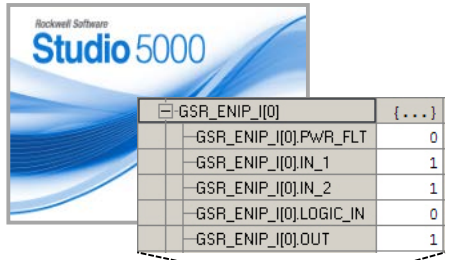
GuardLink™ – enables access to diagnostic information and reduces wiring effort!

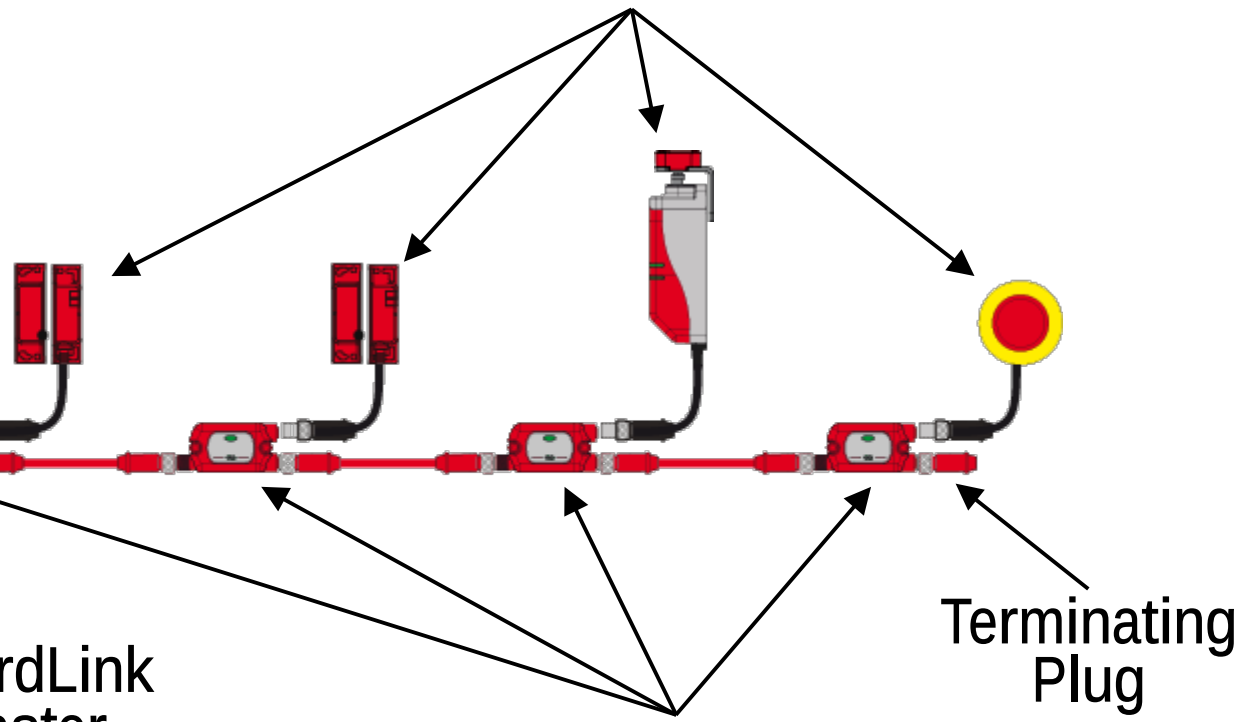
GuardLink™
System Overview

Rockwell Automation

GuardLink
PLe (CAT4) / SIL3

Functional Safety Type Approved
TÜVRheinland FS





Safety Input Devices

Terminating Plug

GuardLink Master (GSR DG)

GuardLink Smart Taps

HMI

Logix 5000 Controller

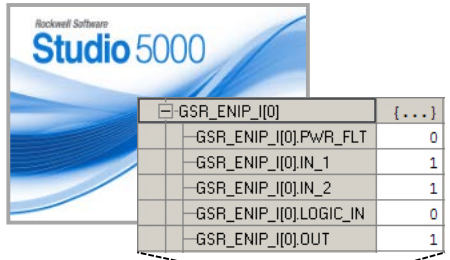
GSR Ethernet

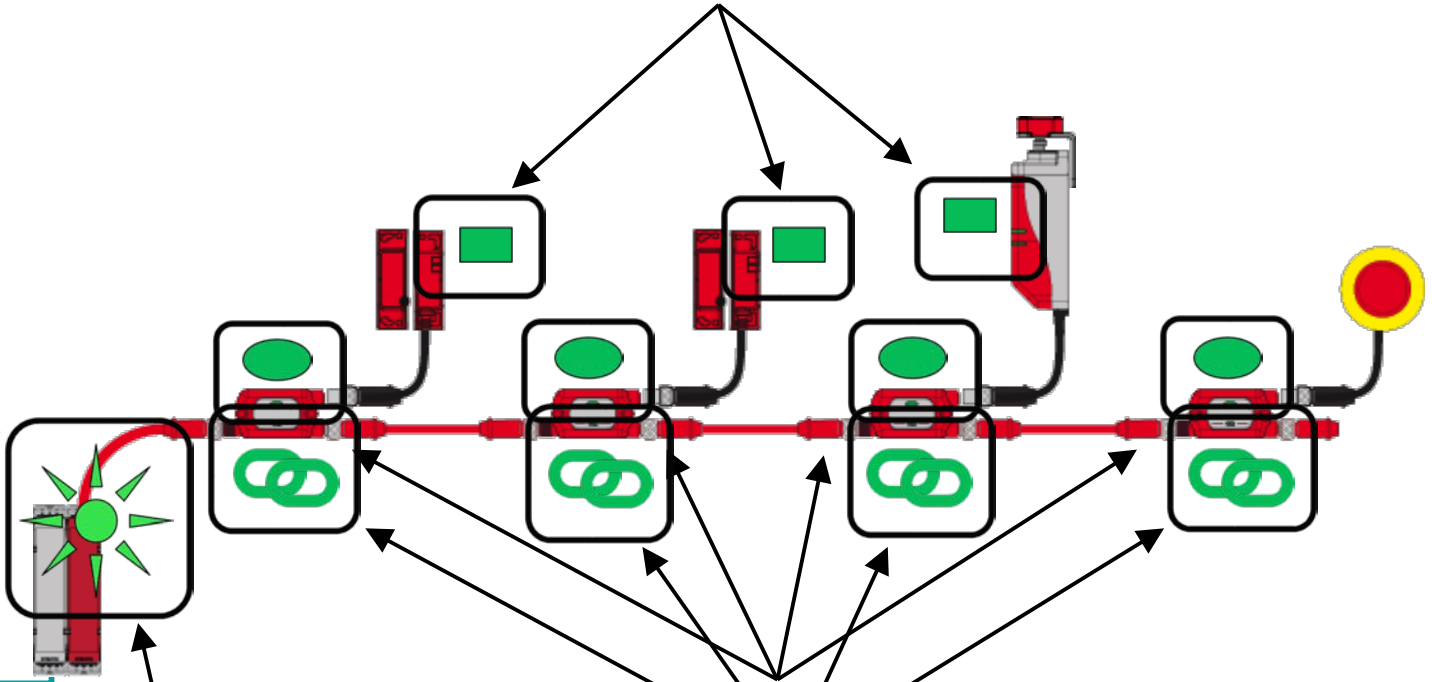
GuardLink™
Operation

Rockwell Automation

GuardLink
PLe (CAT4) / SIL3

Functional Safety Type Approved
TÜVRheinland FS

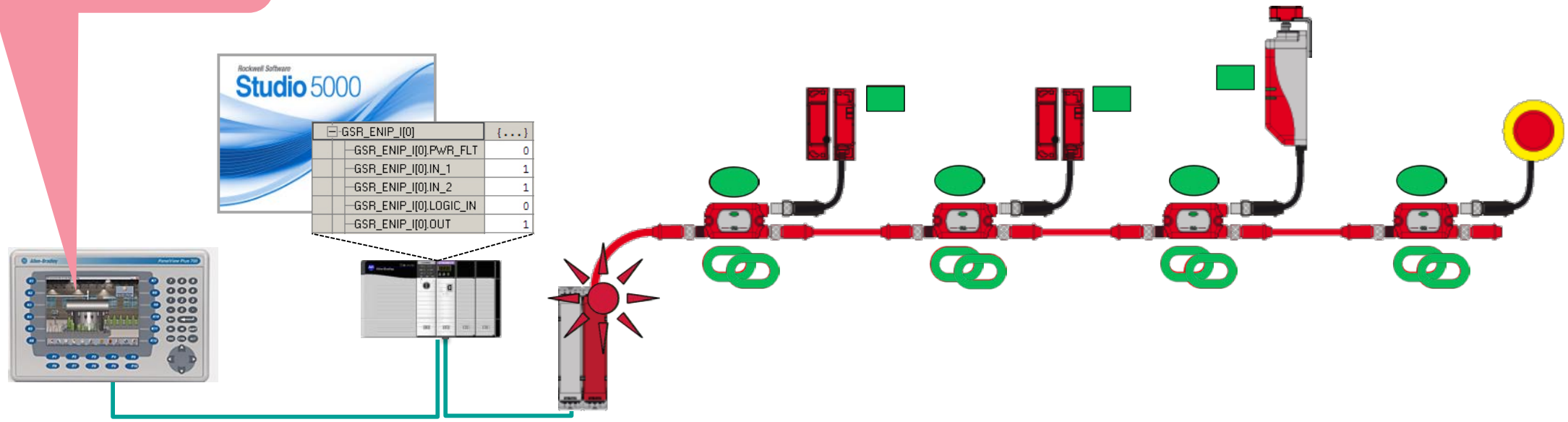




GuardLink™
Operation

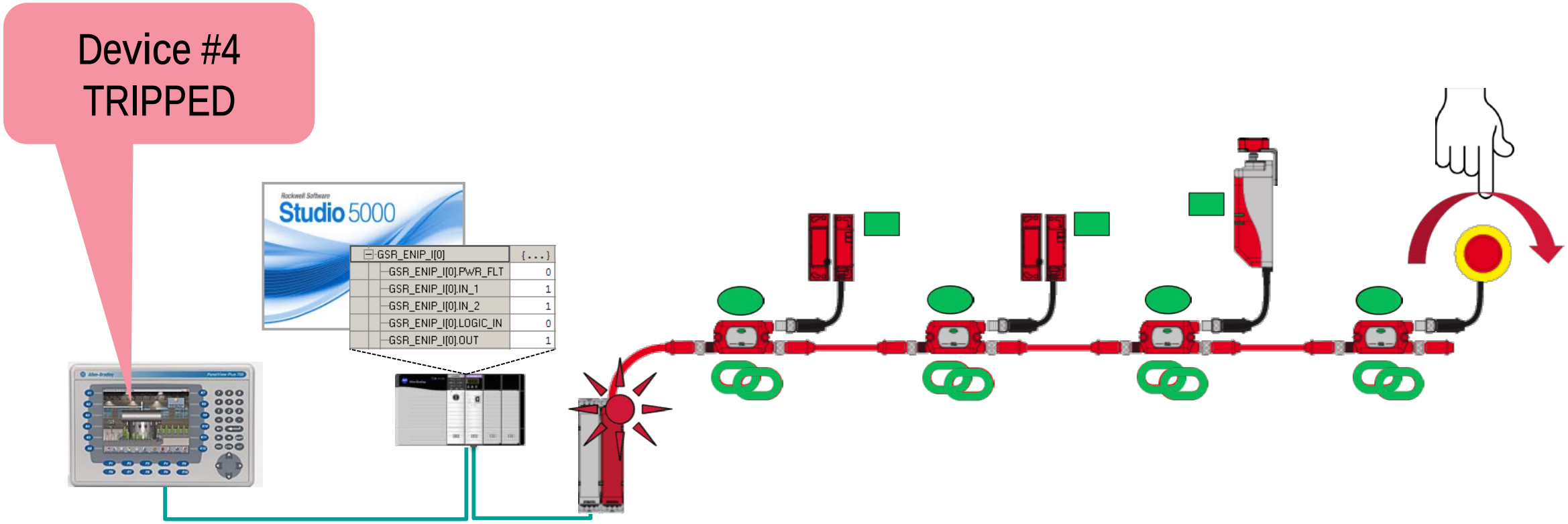
Rockwell Automation

Interlock
Guard #1 OPEN



GuardLink™
Operation

Rockwell Automation



GuardLink™
Overview and Features

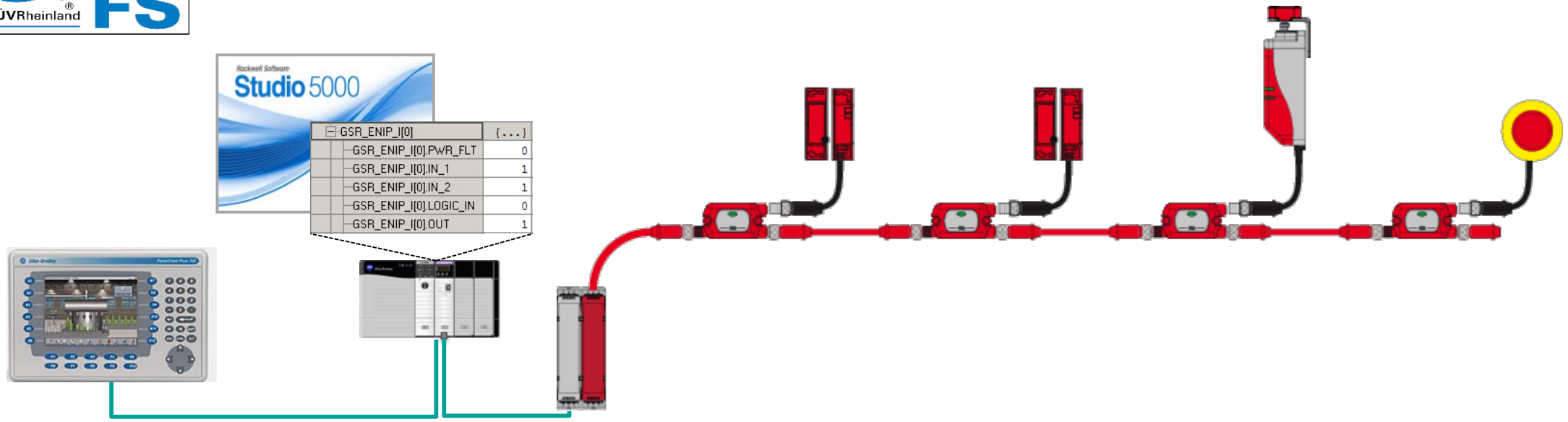
Rockwell Automation

GuardLink

PLe (CAT4) / SIL3

Functional Safety Type Approved

TÜVRheinland FS



GuardLink™
Overview and Features

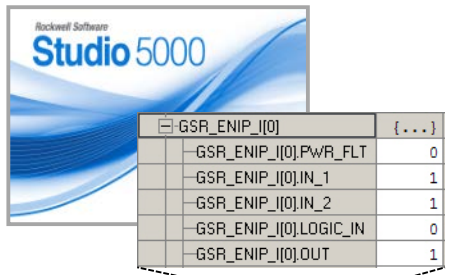
Rockwell Automation

Supports diagnostics, remote reset and lock/unlock command over network

Add-on Profile in Studio 5000 Logix Designer® to seamlessly integrate with Logix5000™ controller platform

Up to 1000 m link distance, max 30 m between devices and 10 m from the tap to the device

Generic safety devices– electromechanical contacts (EMSS) and with solid state output (OSSD)



GuardLink

PLe / SIL3

Functional Safety Type Approved
TÜVRheinland® FS

Up to 32 GuardLink enabled connection taps (SMART taps)

440R-ENETR EtherNet/IP™ interface to share diagnostics over network

Guardmaster® Dual GuardLink (DG) safety relay – GuardLink-enabled safety relay supporting two links

Trunk and drop topology with standard four (trunk) or five/ eight (drop)-wire conductor patch cords

GuardLink™ System

Key Features Summary

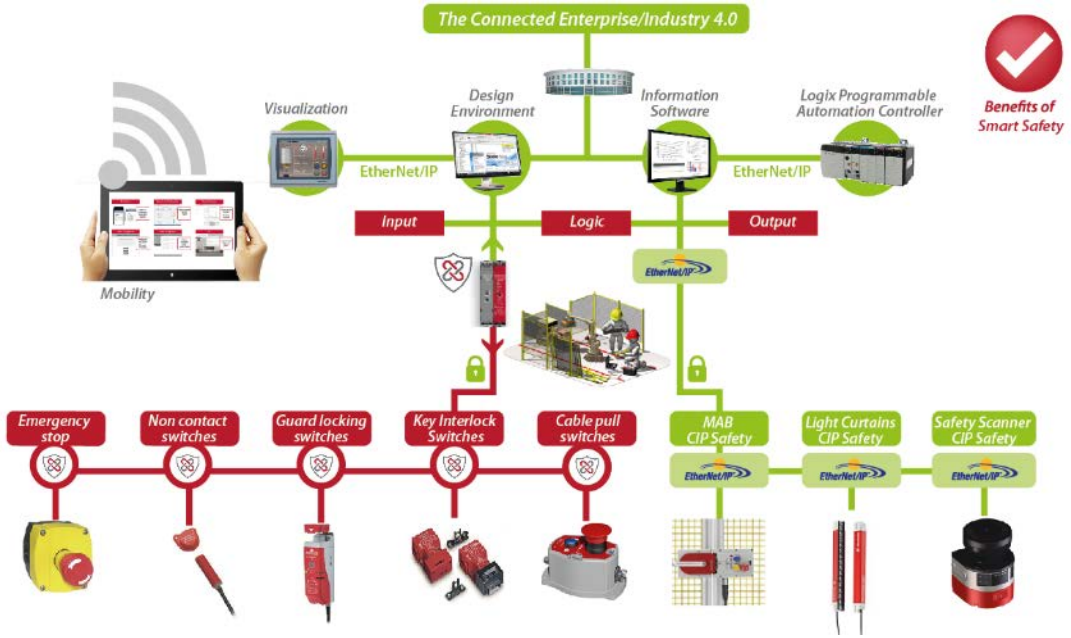
- GuardLink enables smart safety components to share real time data with the standard control system where a direct integration over a network is not achievable due to space and cost constraints of the devices.
- GuardLink seamlessly configures the devices in a daisy chain topology automatically for communicating information with the GuardLink master
- The products will be standardized on M12 Quick disconnect to avoid wiring faults and reduce wiring costs
- GuardLink allows remote Reset, Lock, Unlock and Fault Reset over Ethernet

GuardLink™ in The Connected Enterprise

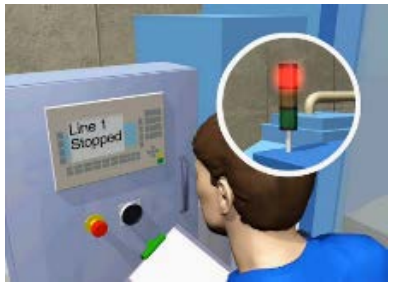
Enabling SMART Machines

Rockwell Automation

SMART connectivity across all platforms – GuardLink and EtherNet/IP™ enable The Connected Enterprise for safety components

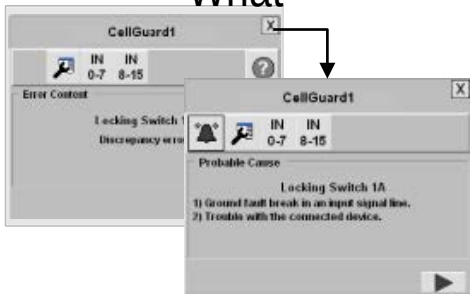


SMART Control and Integration – Transfer of diagnostics into actionable information

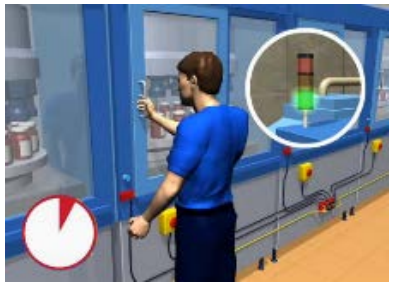


Where

What



How

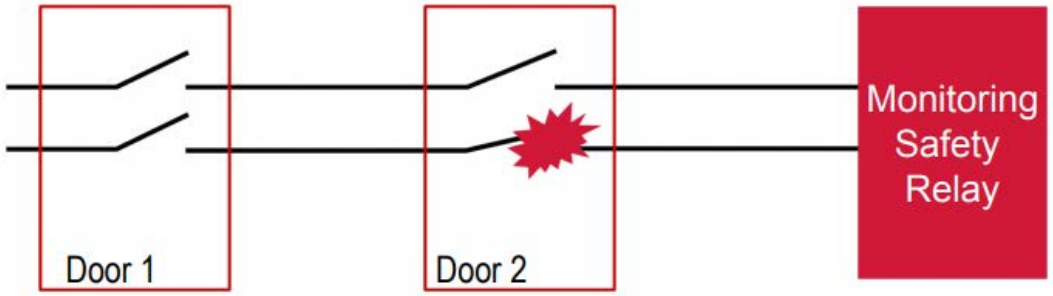


GuardLink™

Increased Safety Rating with Faster Time to Market

Rockwell Automation

Recent changes in EN ISO 14119 prevent series wiring from achieving the highest levels of machinery safety because of the potential for fault masking (Diagnostic Coverage) . . . PLe not possible



Machines moving toward PLe solutions as standard

- Less documentation and analysis required when using PLe

Number of frequently used movable guards[1]	Number of additional movable guards	Masking probability	Diagnostic Coverage	Maximum Achievable PL
0	2 to 4	Low	≥ 60 %	PL d
	5 to 30	Medium	≥ 60 %	PL d
	> 30	High	< 60 % (none)	PL c
1	1	Low	≥ 60 %	PL d
	2 to 4	Medium	≥ 60 %	PL d
	≥ 5	High	< 60 % (none)	PL c
> 1	-	High	< 60 % (none)	PL c

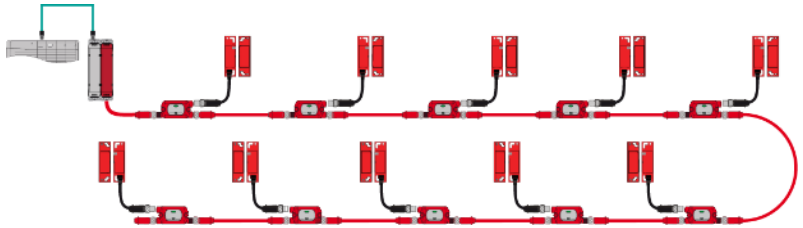
[1]switching frequency greater than once per hour

No Fault masking – GuardLink supports Series wiring with no reduction in Performance Level

GuardLink™ System

Increased efficiency of Daisy Chain implementations

Rockwell Automation

	Taps	GuardLink
		
Description	Safety T-connectors for series connected safety sensors (OSSD)*	GuardLink enabled taps for series connected SensaGuard™
No. of Devices	10	10
Calculation	54ms Sensor 1 + 9x18 ms for Sensor 2 to 10	54ms SensaGuard 1 + 5 ms Guardlink Tap 1 + 9x35 us for Tap 2 to 10
Total Response time	~ 234 ms	~ 59 ms

* Allen Bradley Guardmaster® SensaGuard as baseline

75% reduced response time – Allows shorter safety distances and thus gains additional plant space

GuardLink™ System
Benefits

- Reduction in wiring effort of 20% to 38%
  - Reduced landed wires – 4 conductor cabling for daisy chaining instead of 8-Pin cables
  - Relies on standard M12 connectors and 4 wire cables to reduce wiring faults and save time during installation
- Increased efficiency of Daisy Chain implementations
  - Cascades safety signals across GuardLink devices and enables diagnostics over the same cable
- Remote control lock/unlock and Reset to fasten machinery access and shorten troubleshooting
  - Remote Reset to avoid power cycles e.g. when a device faults due to misalignment or attempting the lock and system will indicate which device faulted

GuardLink™ enabled components

Guardmaster® Safety Relays and connection taps

Dual GuardLink™ Safety Relay

440R-DG2R2T

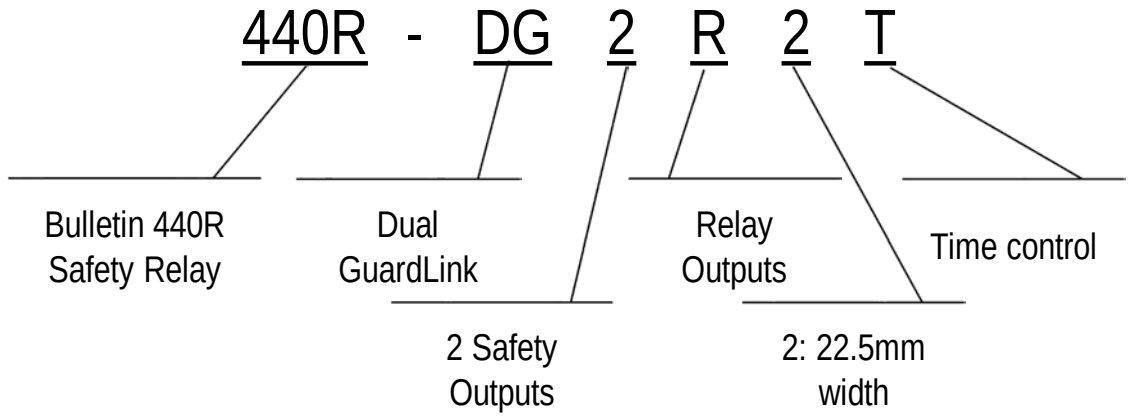
- Supports implementations of two safety circuits
  - GuardLink
  - EMSS or OSSD devices
- Local controls to easily select and configure the safety-related function
  - A few examples of the 20 functions
    - Single input with optional time delay
    - Dual input with optional time delay
    - Dual input with time delay on one Output (Safe Torque Off - Stop Cat 1)
  - Device reset
- Configurable multi-purpose terminals
  - Safety input, safety output and standard signals
- Relay outputs to switch higher loads
- Connectivity to network interface via Optical Link
- Support of Single-Wire Safety (SWS) to cascade multiple safety relays

Dual GuardLink™ Safety Relay

Features

Rockwell Automation

- Matches terminal layout of Guardmaster® Safety Relay (GSR) family
- Eight LED indicators for I/O status indication and configuration
- Simplified indicator theme – Red/green/off; no complex flashing codes
- ControlFLASH™ update via EtherNet/IP Interface
- Enable/disable safety inputs, automatic or monitored reset, SWS and timer
- Simplified safety function configuration via pushbutton selection
- Configurable off-delay time to support Stop Category 1 functionality



- Pass-through of Optical Link 2.0
- Optical Link 3.0
- Two terminals for feedback and reset input
- Two N.O. relay outputs
- Two configurable SWS/OSSD terminals – OSSD to be used for Stop Cat. 1 applications, SWS to support cascading with other GSR safety relays

GuardLink™ Enabled Tap

Smart Connection Tap

- Supports generic Safety input devices in 4 models
  - 5 or 8 pin M12 for OSSD sensor input
  - 5 or 8 pin M12 for EMSS sensor input
- Supports Guardlocking devices
- Provides device location, status information to GuardLink GSR relay
- Two bright indicators for device and link communication status
- Compact design with 40mm width to fit on standard aluminum profiles
- TÜV Approved Ple, CL SIL 3, Cat 4 rated
- IP65/IP67 environmental rating

GuardLink™ Enabled Tap

Features

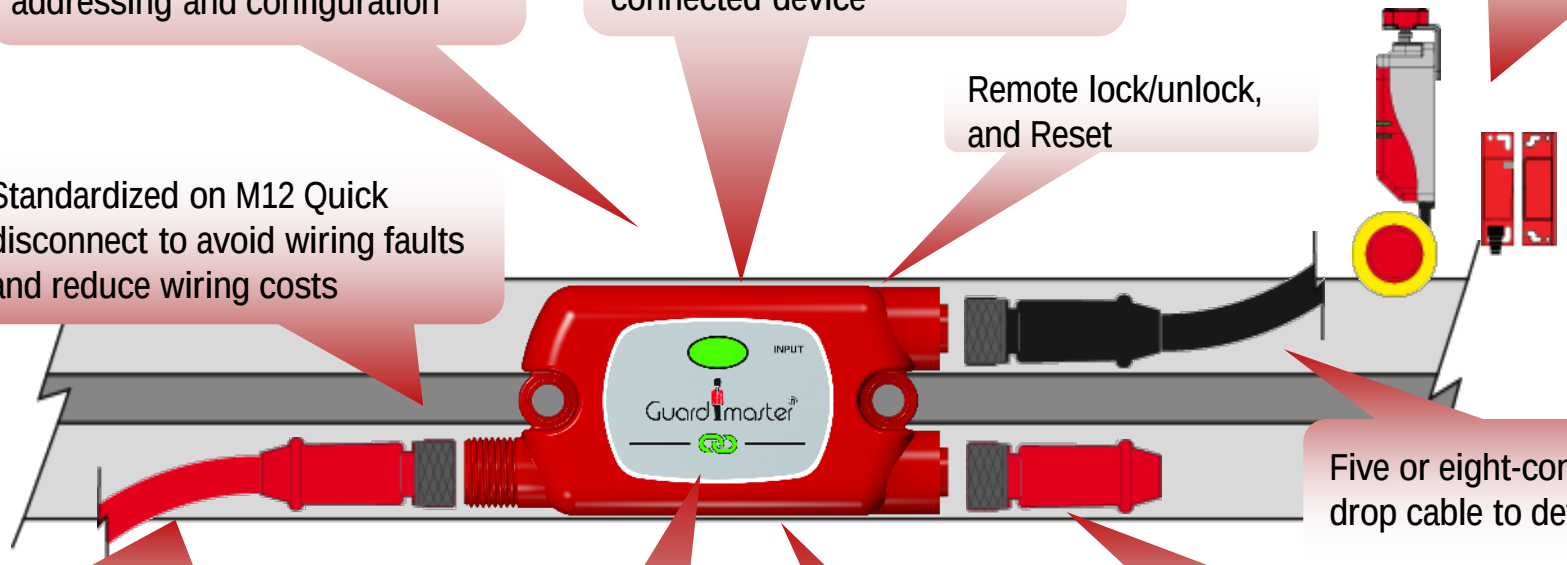
GuardLink-enabled connection tap – safety, diagnostics, auto-addressing and configuration

Device status indicator to identify connector tap status and connected device

Supports generic EMSS and OSSD safety devices

Remote lock/unlock, and Reset

Standardized on M12 Quick disconnect to avoid wiring faults and reduce wiring costs



Five or eight-conductor drop cable to device

Standard patch-cords and cord-Sets– four-conductor trunk cable

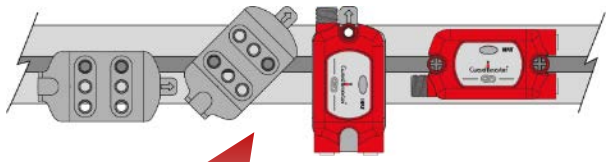
Terminator plug to establish GuardLink connection

Link indicator allows to easily identify link status and locate device in application

Slim design – Plane fit on 40x40 mm aluminum extrusions

440S - S F5 D

- 440S: Bulletin 440S GuardLink connection systems
- S: Function: S – OSSD, M – EMSS
- F5: Drop connector: 5: 5-Pin, 8: 8-Pin
- D: Power connector: D – N/A, D4 – 4-Pin M12



Flexible mounting options – direct screw mount and quick release mounting bracket

GuardLink™ Voltage Drop Calculator

- Allows you to build your GuardLink system and calculate whether the system will need additional power from a GuardLink Passive Power Tap (440S-PF5D4)
  - To calculate the voltage drop of the next segment after the Power Tap, you will need to fill out another Voltage Drop Calculator spreadsheet

Allen-Bradley
Guardmaster
GuardLink

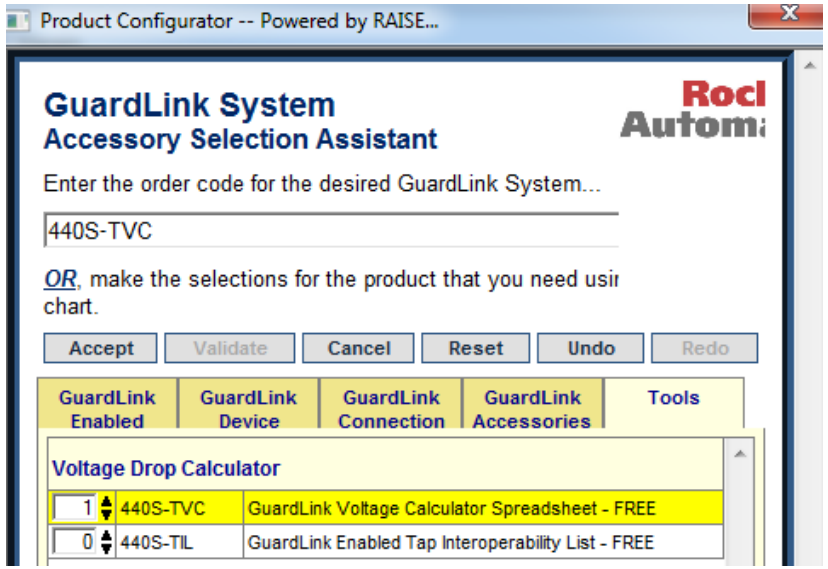
Supply Voltage (20.4 to 26.4)	24	V
Link Cable Wire Gauge	18 (0.823)	AWG (mm^2)
Link Wire Resistance	0.02095	ohms/m

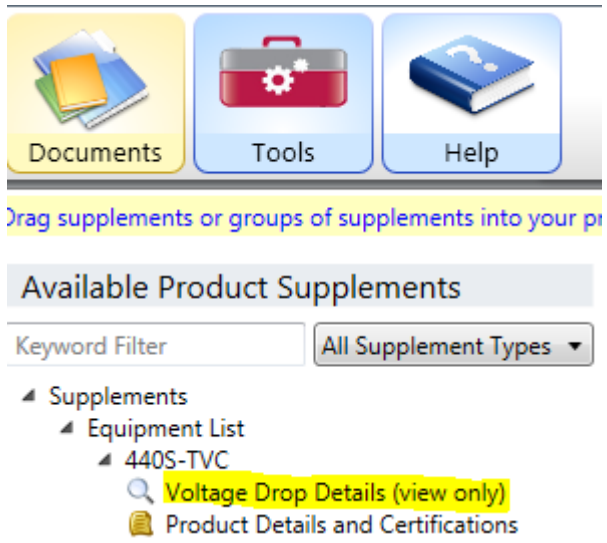
Tap	Link Cable Length (m)	Safety Device	User Defined Device Current (mA)	Tap + Device Current (mA)	Total Current (mA)	Voltage level @ Tap
1	5	SensaGuard Series B		67	616	23.84
2	5	SensaGuard Series B		67	549	23.69
3	5	SensaGuard Series B		67	482	23.56
4	5	SensaGuard Series B		67	415	23.45
5	2	800F E-stop		40	348	23.40
6	5	SensaGuard Series B		67	308	23.32
7	5	SensaGuard Series B		67	241	23.26
8	5	SensaGuard Series B		67	174	23.21
9	5	SensaGuard Series B		67	107	23.18
10	2	800F E-stop		40	40	23.18
11				0	0	NA
12				0	0	NA

GuardLink™ Voltage Drop Calculator

Where to find

- Can be found on Knowledgebase and ProposalWorks
  - Knowledgebase
    - https://rockwellautomation.custhelp.com/app/answers/detail/a_id/1072720
  - ↓ ProposalWorks ↓

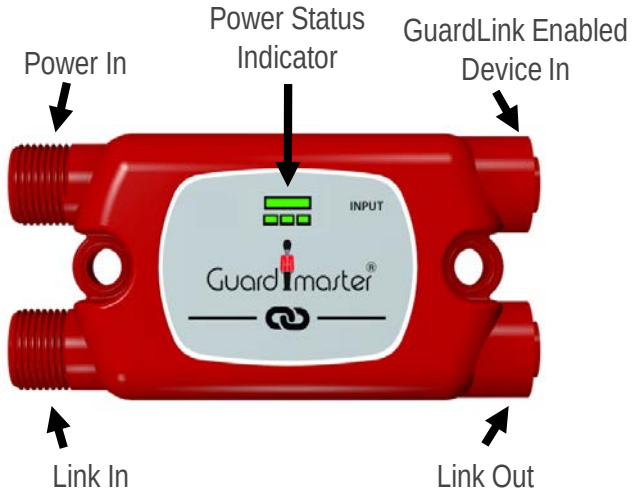


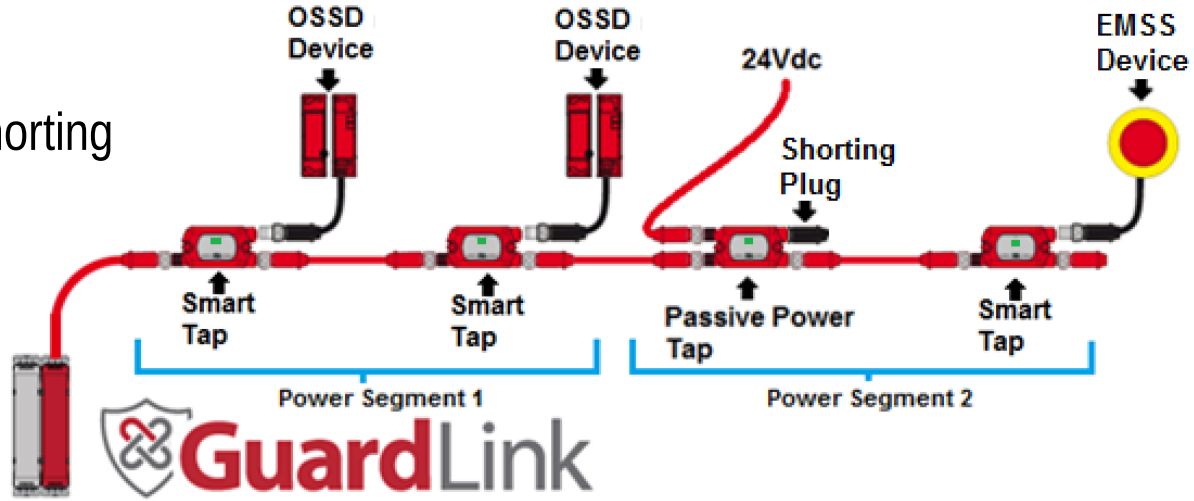


GuardLink™ Passive Power Tap

440S-PF5D4

- Functionality
  - Pass through of signal with the addition of power to the link
  - For increasing voltage to the line to overcome voltage drops
  - Compact design with 40mm width to fit on standard aluminum profiles
  - Bright indicator for status of power being supplied to link through tap
  - Can connect GuardLink Enabled Device to the Device Input port
- Important Notes
  - Must connect either GuardLink Enabled Device or Shorting Plug (898D-41KU-DM2) to Device Port
  - Product is fused to protect against incorrect wiring
  - 7 Passive Power taps max on a single link

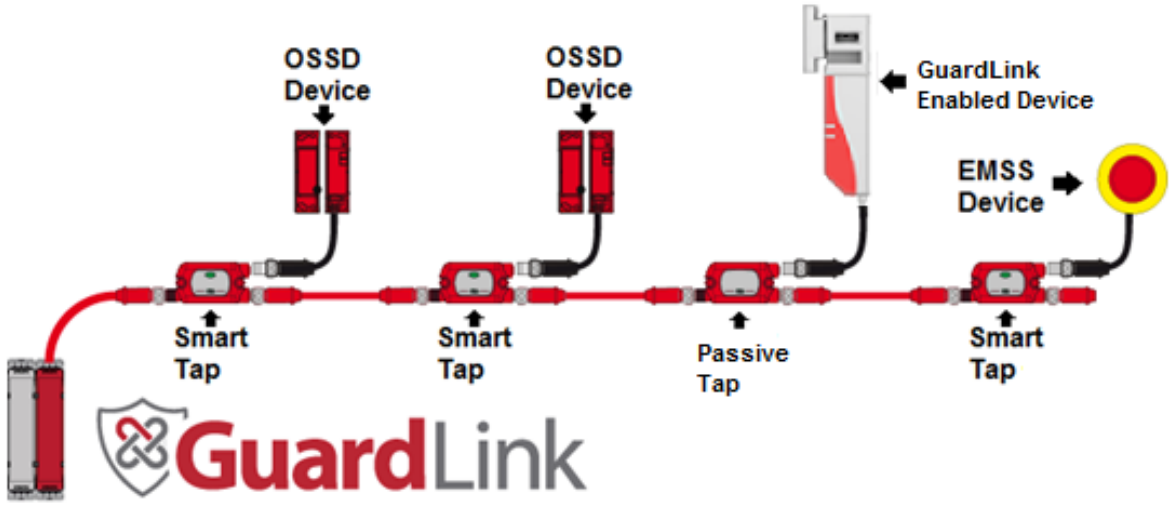




GuardLink™ Passive Tap

440S-PF5D

- Functionality
  - Pass through of GuardLink signal to GuardLink Enabled Device
  - Compact design with 40mm width to fit on standard aluminum profiles
- Important Notes
  - Only for use with GuardLink Enabled Devices (i.e. 440G-MZ)
  - No status LEDs on Tap



Guardmaster® EtherNet/IP™ Interface

440R-ENETR Series B

Rockwell Automation

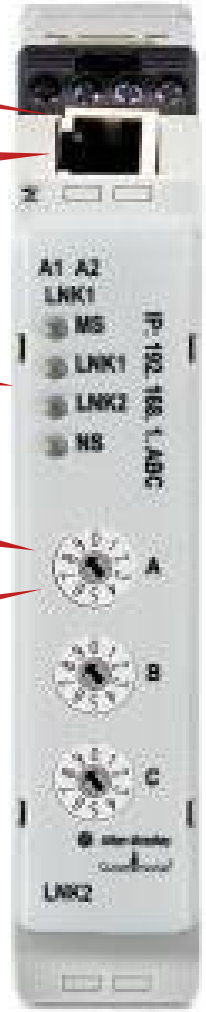
Embedded switch to support DLR

EtherNet/IP communication to pass information from Guardmaster Safety Relays (GSR) and GuardLink to PLC

Supports Guardmaster safety relays with OpticalLink 2.0 and 3.0

Rotary switches to set last three digits of IP address and switch operating modes

ControlFLASH™ support to allow field updates



Optical Link 2.0

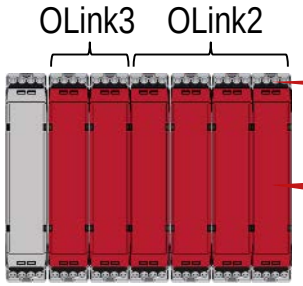
Optical Link 3.0

440R - ENET R

Bulletin 440R Safety Relay

EtherNet/IP

R: DLR



Up to 6 GSR on optical backplane

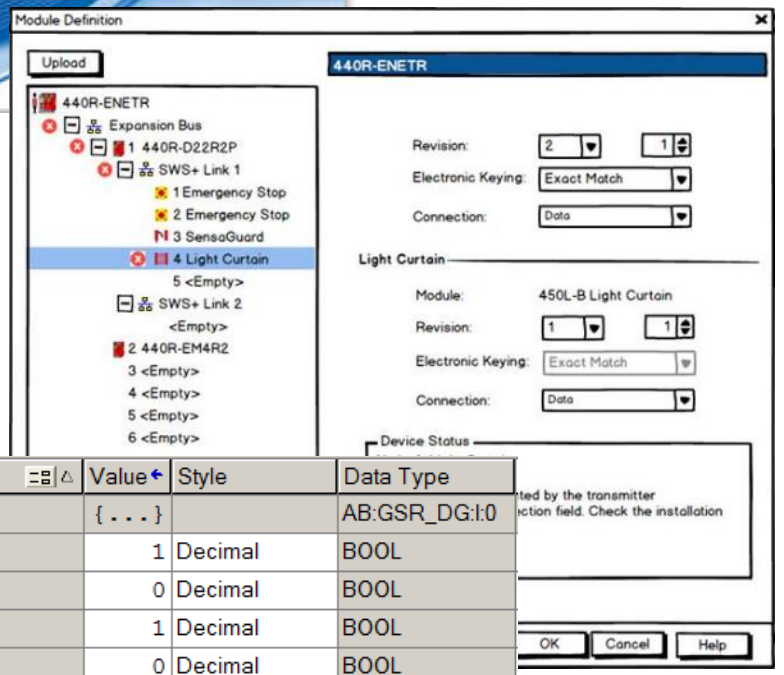
OpticalLink 3.0 devices must be on the left next to 440R-ENETR module pass-through of OpticalLink 2.0

Supported GuardMaster Safety Relays

Catalog	Device	OLink 2 Rev.	OLink 3 Rev.
440R-S12R2	GSR SI	FW 2 or later	n/a
440R-D22R2	GSR DI	FW 2 or later	n/a
440R-D22S2	GSR DIS	FW 2 or later	n/a
440R-EM4R2	GSR EM	FW 2 or later	n/a
440R-EM4R2D	GSR EMD	FW 2 or later	n/a
440R-GL2S2P	GSR GLP	FW 2 or later	n/a
440R-GL2S2T	GSR GLT	FW 2 or later	n/a
440R-DG2R2T	GSR DG	Pass-through	FW 1.00 or later

GuardLink™ Integration
AOP

- Easy integration within Studio 5000® v20 and newer
- Single software required for product configuration
- Tags are automatically populated in the controller
- Tags when using the AOP, allowing for easy integration into Logix 5000™ program



Name	Value	Style	Data Type
ENETR_IP120:I.Relay1_GSR_DG	{ . . . }		AB:GSR_DG:I:0
ENETR_IP120:I.Relay1_GSR_DG.SafetyInput01	1	Decimal	BOOL
ENETR_IP120:I.Relay1_GSR_DG.SafetyInput02	0	Decimal	BOOL
ENETR_IP120:I.Relay1_GSR_DG.PtS12	1	Decimal	BOOL
ENETR_IP120:I.Relay1_GSR_DG.PtS22	0	Decimal	BOOL
ENETR_IP120:I.Relay1_GSR_DG.PtS32	0	Decimal	BOOL
ENETR_IP120:I.Relay1_GSR_DG.PtS42	0	Decimal	BOOL
ENETR_IP120:I.Relay1_GSR_DG.PtS11	0	Decimal	BOOL
ENETR_IP120:I.Relay1_GSR_DG.PtS21	0	Decimal	BOOL
ENETR_IP120:I.Relay1_GSR_DG.PtX2	0	Decimal	BOOL

GuardLink™

Technology overview

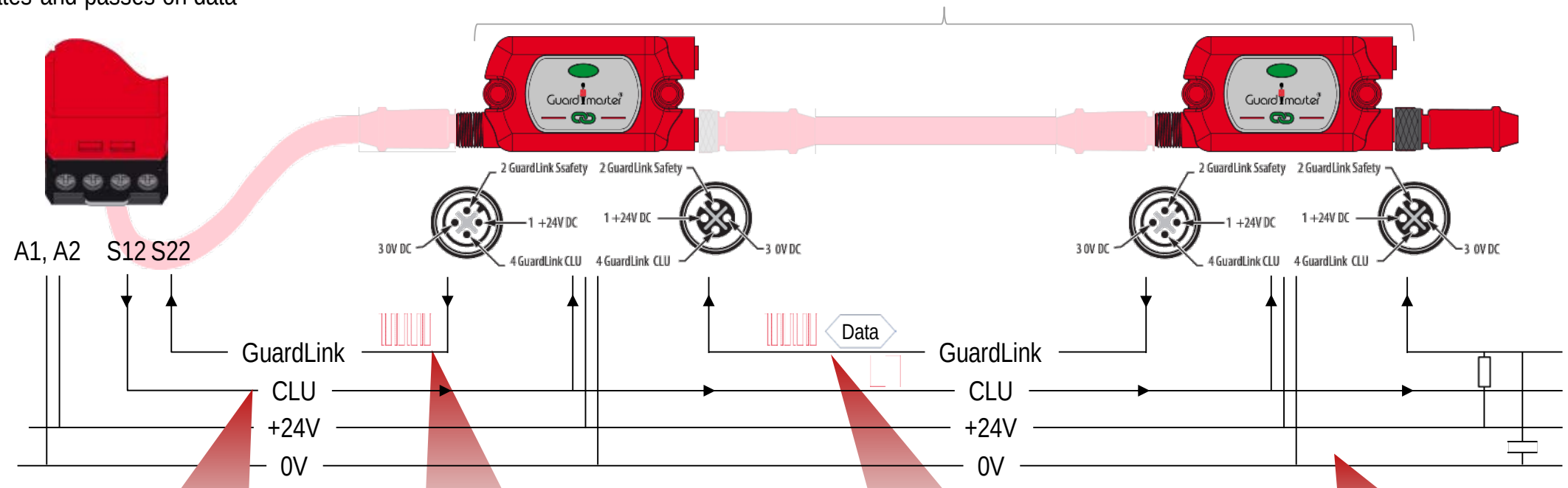
GuardLink™ Technology Overview

Principle function

GuardLink master
Manages GuardLink comms.
Executes the safety function
Aggregates and passes on data

GuardLink slave
Monitors safeguarding device
Creates and repeats safety pattern

GuardLink Terminator
Terminates open wires
Determines last device on Link



CLU – Command, Lock and Unlock Connection to manage operation modes and initiate lock/unlock

Unique safety pattern to achieve PLe/CL SIL3

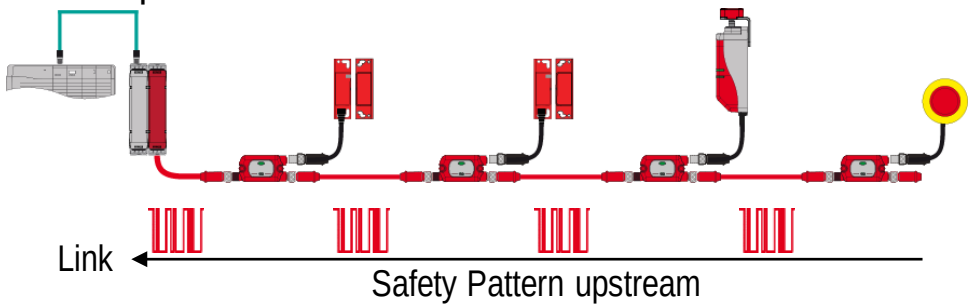
Safety or diagnostics on the same single wire

Distribution of 24V across GuardLink devices - Same 0V reference required for master and slaves

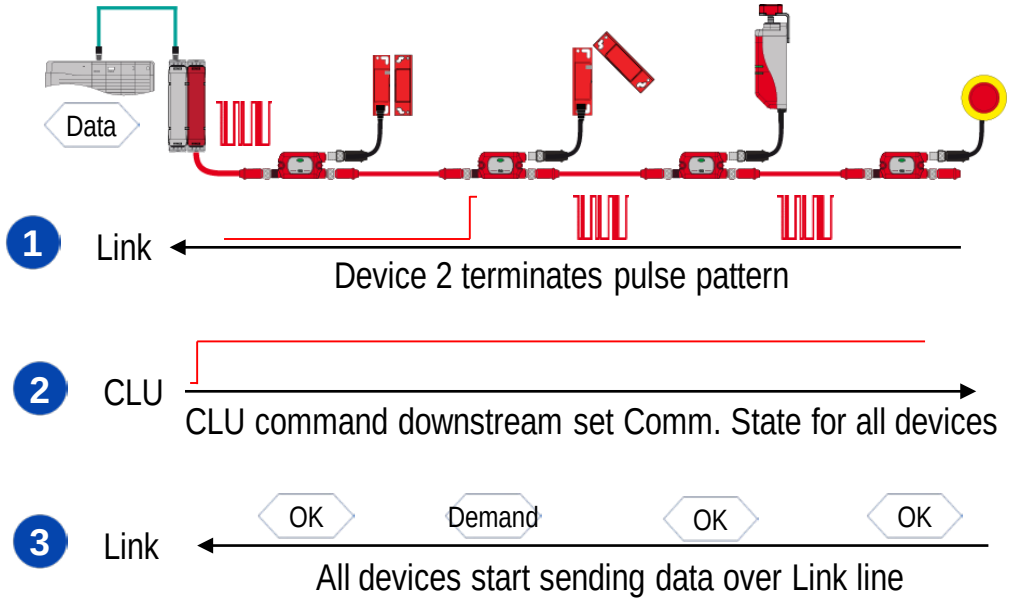
GuardLink™ Technology Overview

Principle function

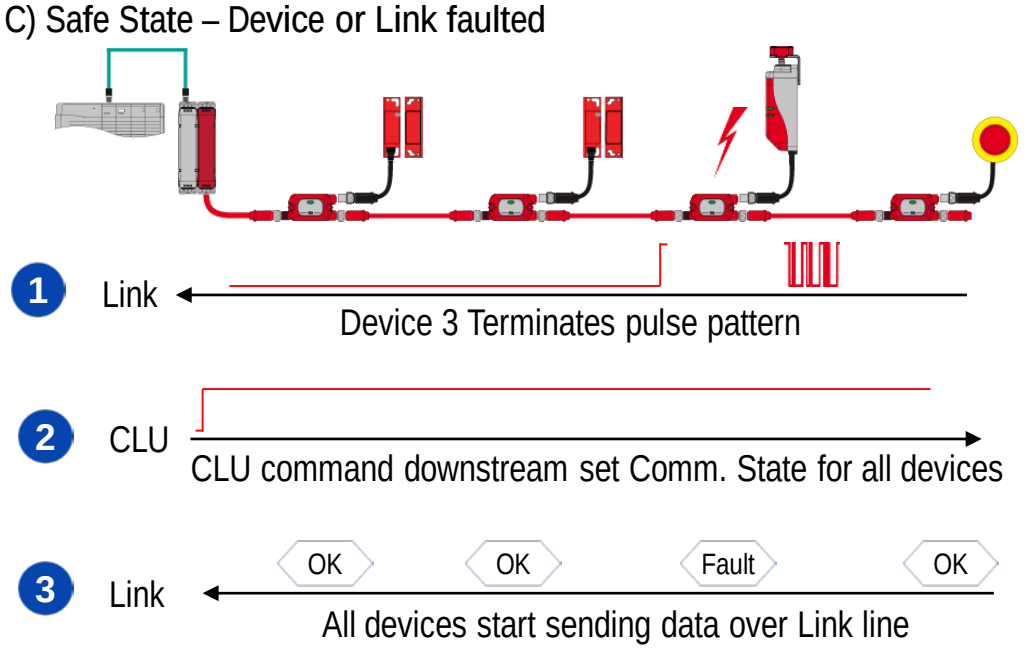
A) Normal Operation – “OK to RUN”



B) Safe State – at least one device has a demand

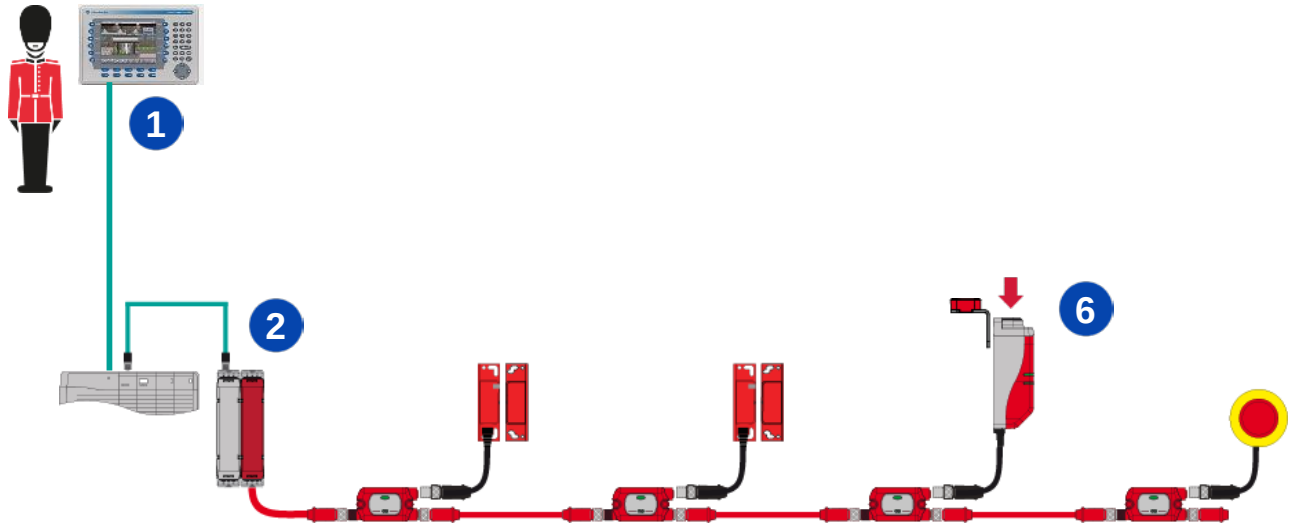


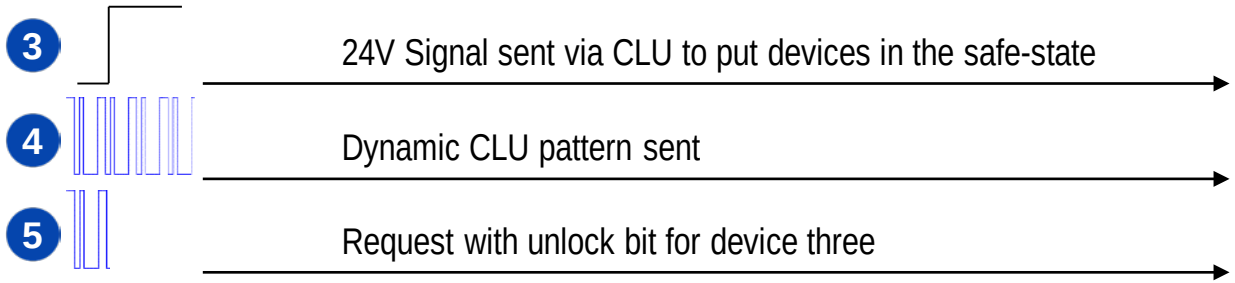
C) Safe State – Device or Link faulted



GuardLink™ Use Cases

Unlock



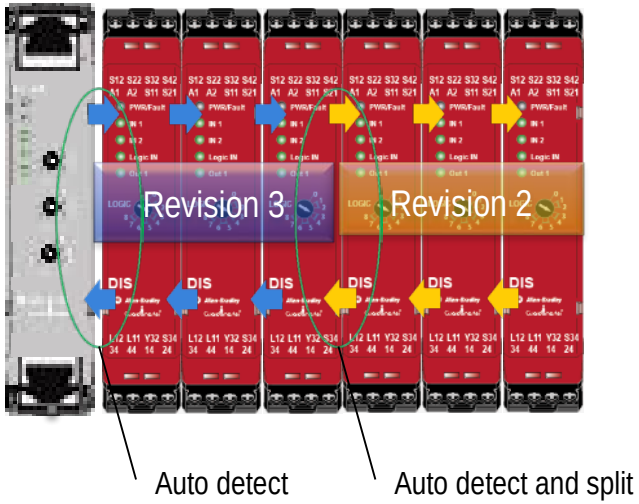


1. User requests access
2. GuardLink Master receives request
3. GuardLink Master sets CLU to 24V. This puts devices in the Safe State (diagnostics).
4. Comms Master verifies hazardous item is safe, then changes the CLU to the dynamic signal.
5. Through a diagnostics request the Comms Master instructs device 3 to unlock.
6. Device 3 responds to a diagnostic request that it is unlocked

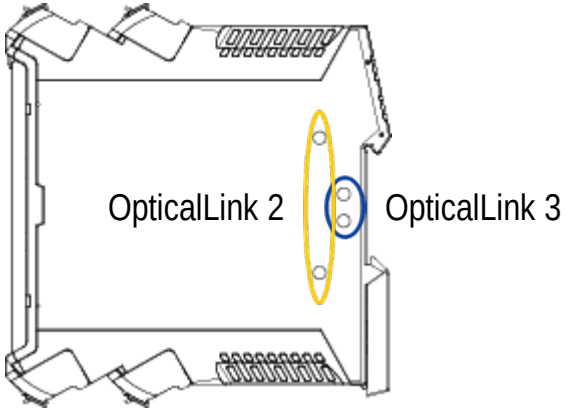
- Individual and global Unlock/lock command – each locking switch can be unlocked individually or all at once
- Built-in latency time to unlock each switch subsequently to avoid high current draws
- Three states of CLU
  - 0V – Normal operation
  - 24V – Devices go to the safe state
  - Known dynamic signal – Devices respond to lock commands.
- Lock/Unlock only enabled over network

OpticalLink
Compatibility

- 440R-ENETR series B supports both OpticalLink 2.0 and OpticalLink 3.0
- OpticalLink is a communication protocol based on a non-contact infrared interface and a protocol similar to Modbus
- OpticalLink is used to communicate across up to six Guardmaster® Safety Relays (GSR) and gather data by a gateway to share this with superior control
- OpticalLink is designed for auto-addressing – No configuration required
- GSR with Optical Link 3.0 will allow a pass-through of data over OpticalLink 2.0 to allow combination of multiple GSR variants
- Required to group GSR modules with OpticalLink 3.0 modules next to the 440R-ENETR module and OpticalLink after them to them to the right



	OpticalLink 2.0	OpticalLink 3.0
Connectivity	2 hole discrete IR circuits	1 hole IR transceiver
Baud rate	9600 bps	115200 bps



Rev 3 Rev 2

GuardLink™

Commercial Material & Ordering information

GuardLink™
Ordering Information

Sap Material Master	Part numbers	Description
	GuardLink Enabled Taps	
PN-355640	440S-MF5D	GuardLink Enabled Tap M12 5 Pin EMSS (Electromechanical Saftey Switch) contacts
PN-355642	440S-MF8D	GuardLink Enabled Tap M12 8 Pin EMSS (Electromechanical Safety Switch) contacts
PN-422331	440S-SF5D	GuardLink Enabled Tap M12 5 Pin OSSD (Output Switching Signal Device) contacts
PN-422342	440S-SF8D	GuardLink Enabled Tap M12 8 Pin OSSD (Output Switching Signal Device) contacts
PN-514855	440S-PF5D4	GuardLink Passive Power Tap
PN-441618	440S-PF5D	GuardLink Passive Tap
	Shorting Plug /Terminator	
PN-355643	898D-418U-DM2	GuardLink Terminator
PN-507887	898D-41KU-DM2	GuardLink Enabled Device Input Shorting Plug
	Mounting Bracket	
PN-463839	440S-GLTAPBRK1	GuardLink Tap Mounting Bracket - QTY 1
PN-463841	440S-GLTAPBRK5	GuardLink Tap Mounting Bracket - QTY 5
	Safety Relay	
PN-417415	440R-DG2R2T	Guardmaster® Safety Relay Dual GuardLink Input with time control
	440R-ENETR	Guardmaster® Safety Relay Ethernet Gateway

GuardLink™

Resources and Collateral

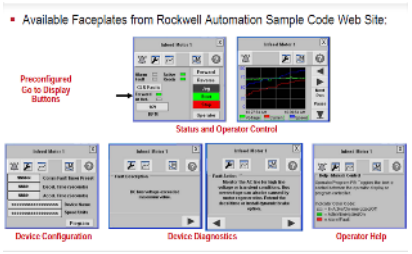
Category	Resource	File names/hyperlink
System Overview	GuardLink Brochure	http://literature.rockwellautomation.com/idc/groups/literature/documents/br/glink-br001_-en-p.pdf
	Smart Safety Brochure	http://literature.rockwellautomation.com/idc/groups/literature/documents/br/safety-br002_-en-p.pdf
Product Documentation	GuardLink Users Manual	http://literature.rockwellautomation.com/idc/groups/literature/documents/um/440r-um015_-en-p.pdf
	Guardmaster® 440R Dual GuardLink Safety Relay Product Profile	http://literature.rockwellautomation.com/idc/groups/literature/documents/pp/440r-pp002_-en-p.pdf
	Guardmaster® 440R Dual GuardLink Safety Relay Package Content	http://literature.rockwellautomation.com/idc/groups/literature/documents/pc/440r-pc004_-en-p.pdf
	Guardmaster® 440S GuardLink Enabled Tap Installation Instruction	http://literature.rockwellautomation.com/idc/groups/literature/documents/in/440s-in007_-en-p.pdf
	Guardmaster® 440S GuardLink Passive Power Tap Installation Instructions	https://literature.rockwellautomation.com/idc/groups/literature/documents/in/440s-in009_-en-p.pdf
	Guardmaster® 440S GuardLink Passive Tap Installation Instructions	https://literature.rockwellautomation.com/idc/groups/literature/documents/in/440s-in008_-en-p.pdf
	Guardmaster® 440S GuardLink enabled Tap Product Profile	http://literature.rockwellautomation.com/idc/groups/literature/documents/pp/440s-pp001_-en-p.pdf
	Guardmaster® 440R-ENETR EtherNet/IP™ gateway Product Profile	http://literature.rockwellautomation.com/idc/groups/literature/documents/pp/440r-pp001_-en-p.pdf
	Guardmaster® 440R-ENETR EtherNet/IP gateway Installation Instructions	http://literature.rockwellautomation.com/idc/groups/literature/documents/in/440r-in078_-en-p.pdf

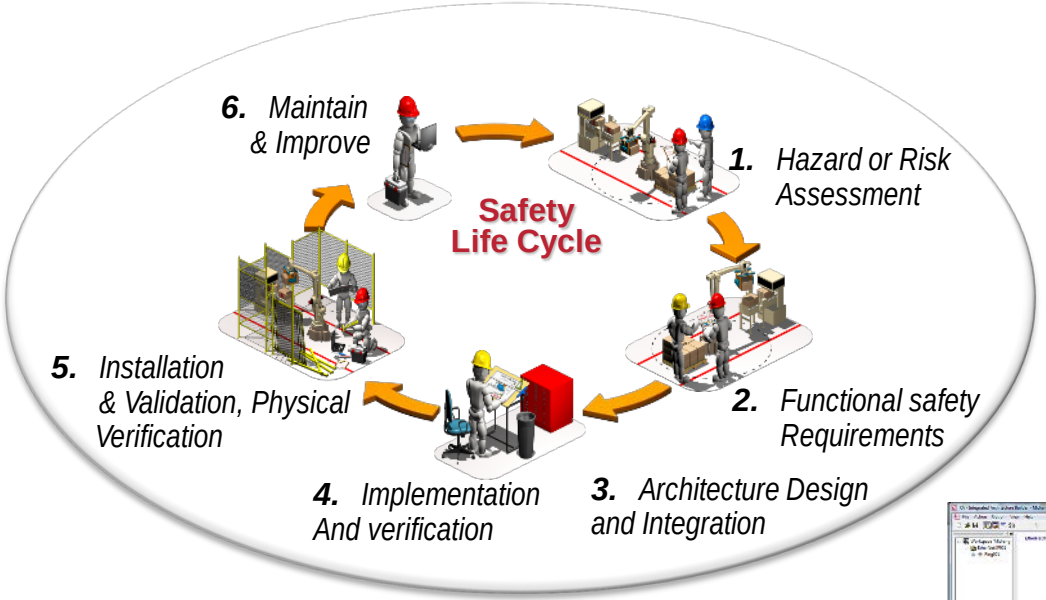
GuardLink™
Tools & Services

Rockwell Automation

Coming soon

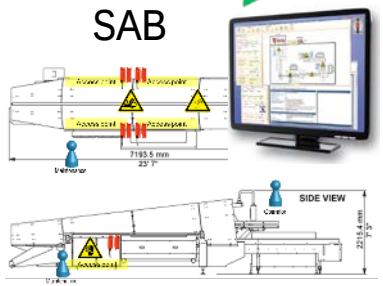
Contextual information - Faceplates



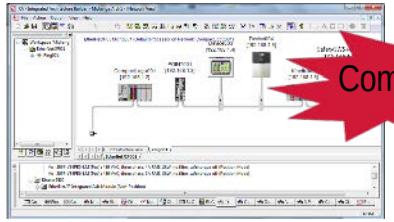


AFD

SAB



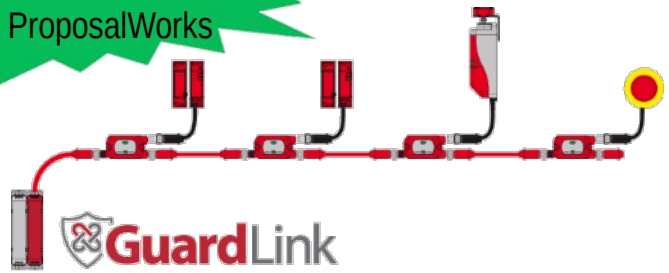
IAB



Coming soon

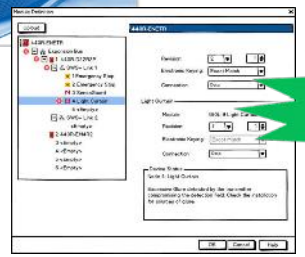
AFD – via ProposalWorks

Voltage Drop calculator



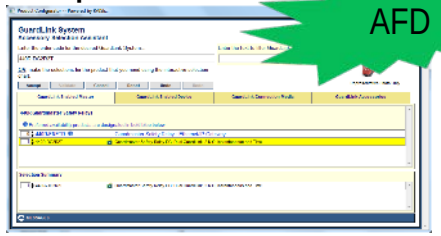
RSStudio Designer

AOP



AFD

ProposalWorks



AFD

LISTEN. THINK. SOLVE.®

Thank You!

PUBLIC

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