ctrl**X** SAFETY

How to determine which SAFEX safe data exchange should be used
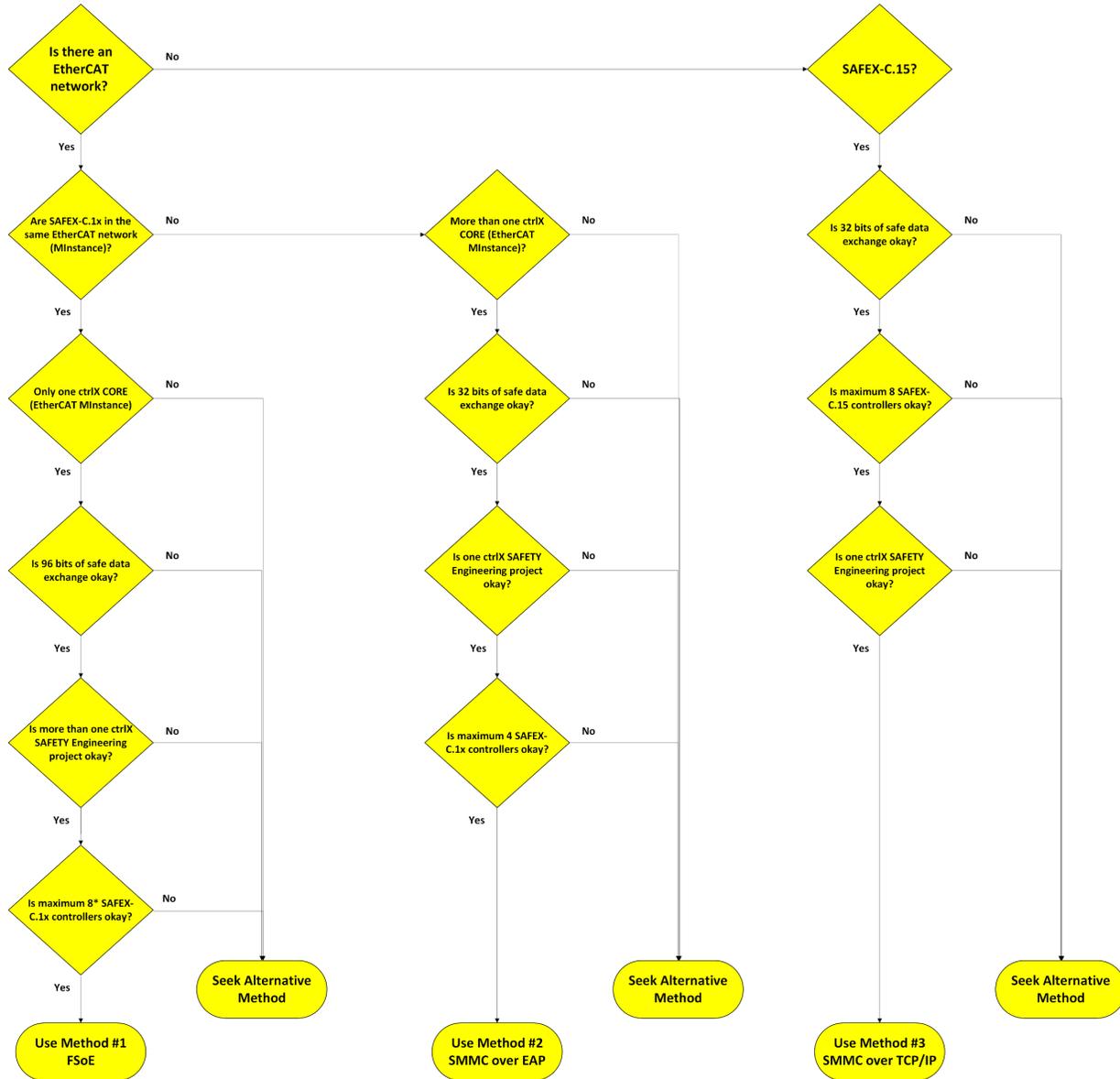
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ctrl**X** SAFETY

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How to determine which SAFEX safe data exchange should be used Things to consider

▶ Is there an EtherCAT network?

▶ Are SAFEX-C.1x controls in the same EtherCAT network or different EtherCAT networks?

▶ More than one ctrlX CORE?

▶ SAFEX-C.12 or SAFEX-C.15?

▶ Number of SAFEX-C.1x controllers?

▶ Amount of safe data exchange needed?

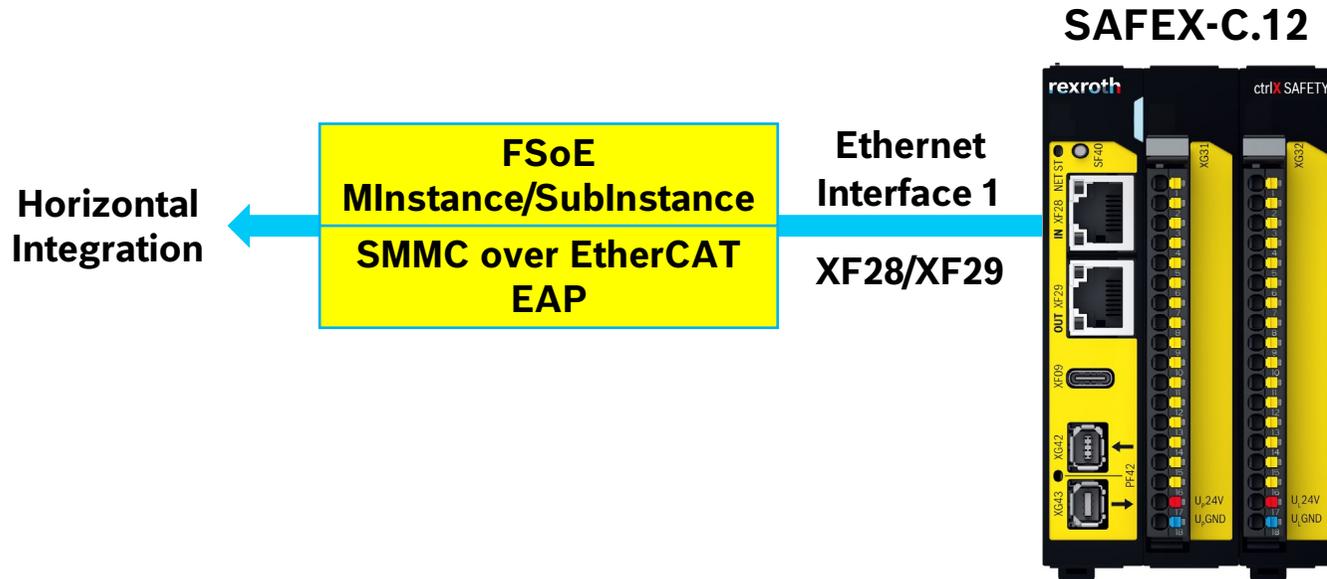▶ Project management, one or more than one ctrlX SAFETY Engineering projects?

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Is there an EtherCAT network?
— No → **SAFEX-C.15?**
— Yes ↓

Are SAFEX-C.1x in the same EtherCAT network (MInstance)?
— No → **More than one ctrlX CORE (EtherCAT MInstance)?**
— Yes ↓

Only one ctrlX CORE (EtherCAT MInstance)
— No →
— Yes ↓

Is 96 bits of safe data exchange okay?
— No →
— Yes ↓

Is more than one ctrlX SAFETY Engineering project okay?
— No →
— Yes ↓

Is maximum 8* SAFEX-C.1x controllers okay?
— No →
— Yes ↓

Use Method #1 FSoE

More than one ctrlX CORE (EtherCAT MInstance)?
— No →
— Yes ↓

Is 32 bits of safe data exchange okay?
— No →
— Yes ↓

Is one ctrlX SAFETY Engineering project okay?
— No →
— Yes ↓

Is maximum 4 SAFEX-C.1x controllers okay?
— No →
— Yes ↓

Use Method #2 SMMC over EAP

SAFEX-C.15?
— Yes ↓

Is 32 bits of safe data exchange okay?
— No →
— Yes ↓

Is maximum 8 SAFEX-C.15 controllers okay?
— No →
— Yes ↓

Is one ctrlX SAFETY Engineering project okay?
— No →
— Yes ↓

Use Method #3 SMMC over TCP/IP

Seek Alternative Method

Seek Alternative Method

Seek Alternative Method

* Maximum FSoE data is 228 bytes. If other FSoE devices are used in the network this value is reduced

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How to determine which SAFEX safe data exchange should be used SAFEX-C.12-to-SAFEX-C.12 two safe data exchange methods
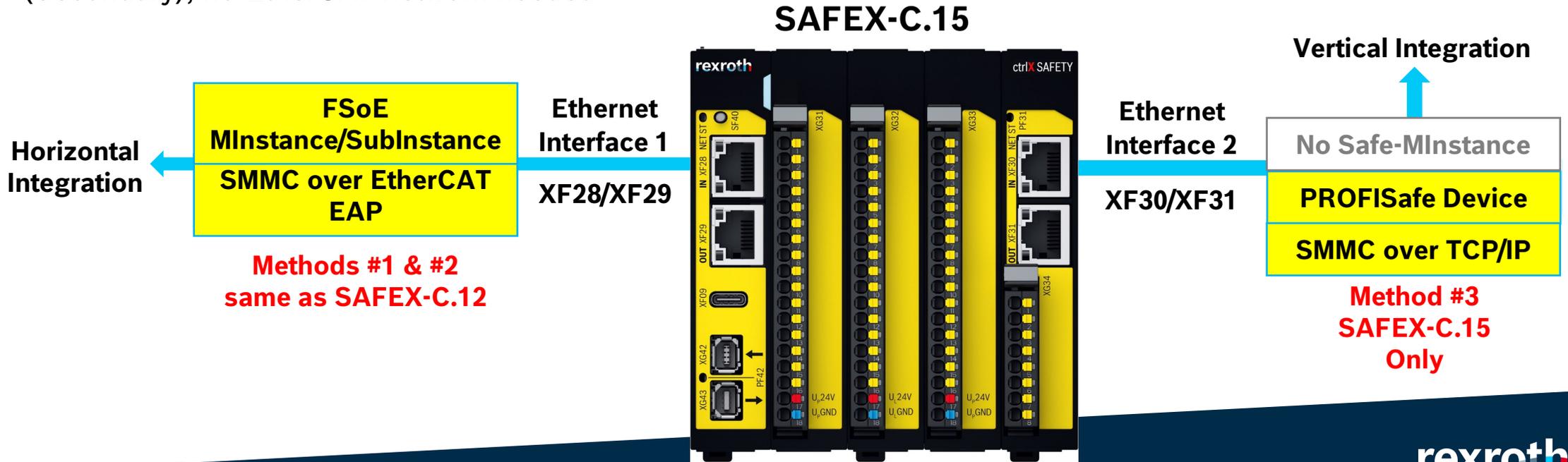
1. Safety over EtherCAT (FSoE) on Ethernet Interface 1 XF28/XF29 (Primary), same EtherCAT network

2. Safe MainInstance-to-MainInstance Communication (SMMC) over EtherCAT Automation Protocol (EAP) on Ethernet Interface 1 XF28/XF29 (Primary), different EtherCAT networks

SAFEX-C.12

Horizontal Integration

FSoE MInstance/SubInstance

SMMC over EtherCAT EAP

Ethernet Interface 1

XF28/XF29

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How to determine which SAFEX safe data exchange should be used SAFEX-C.15-to-SAFEX-C.15 three safe data exchange methods

1. Safety over EtherCAT (FSoE) on Ethernet Interface 1 XF28/XF29 (Primary), same EtherCAT network

2. Safe MainInstance-to-MainInstance Communication (SMMC) over EtherCAT Automation Protocol (EAP) on Ethernet Interface 1 XF28/XF29 (Primary), different EtherCAT networks

3. Safe MainInstance-to-MainInstance Communication (SMMC) over TCP/IP Ethernet Interface 2 XF30/XF31 (Secondary), no EtherCAT network needed

SAFEX-C.15

Vertical Integration

Horizontal Integration

FSoE MInstance/SubInstance
SMMC over EtherCAT EAP

Methods #1 & #2 same as SAFEX-C.12

Ethernet Interface 1
XF28/XF29

Ethernet Interface 2
XF30/XF31

No Safe-MInstance
PROFISafe Device
SMMC over TCP/IP

Method #3 SAFEX-C.15 Only

How to determine which SAFEX safe data exchange should be used
SAFEX-to-SAFEX safe data exchange Method #1 FSoE

- ▶ Up to 8* **ctrlX SAFETY** controllers via **Safety over EtherCAT FSoE (maximum 228 bytes per direction)**

- ▶ Allows connection within single EtherCAT network (**ctrlX CORE** /EtherCAT MInstance)

- ▶ 96 input/output bits per controller

- ▶ SubInstance-to-SubInstance data must pass through MInstance controller

- ▶ Separate **ctrlX SAFETY Engineering** Projects for each SAFEX controller

- ▶ **FSoE** between **ctrlX SAFETY** controllers **extends and scales capacity**
  - ▶ in CPU power and
  - ▶ Number of I/O

SAFEX-C.12/15 FSoE MInstance

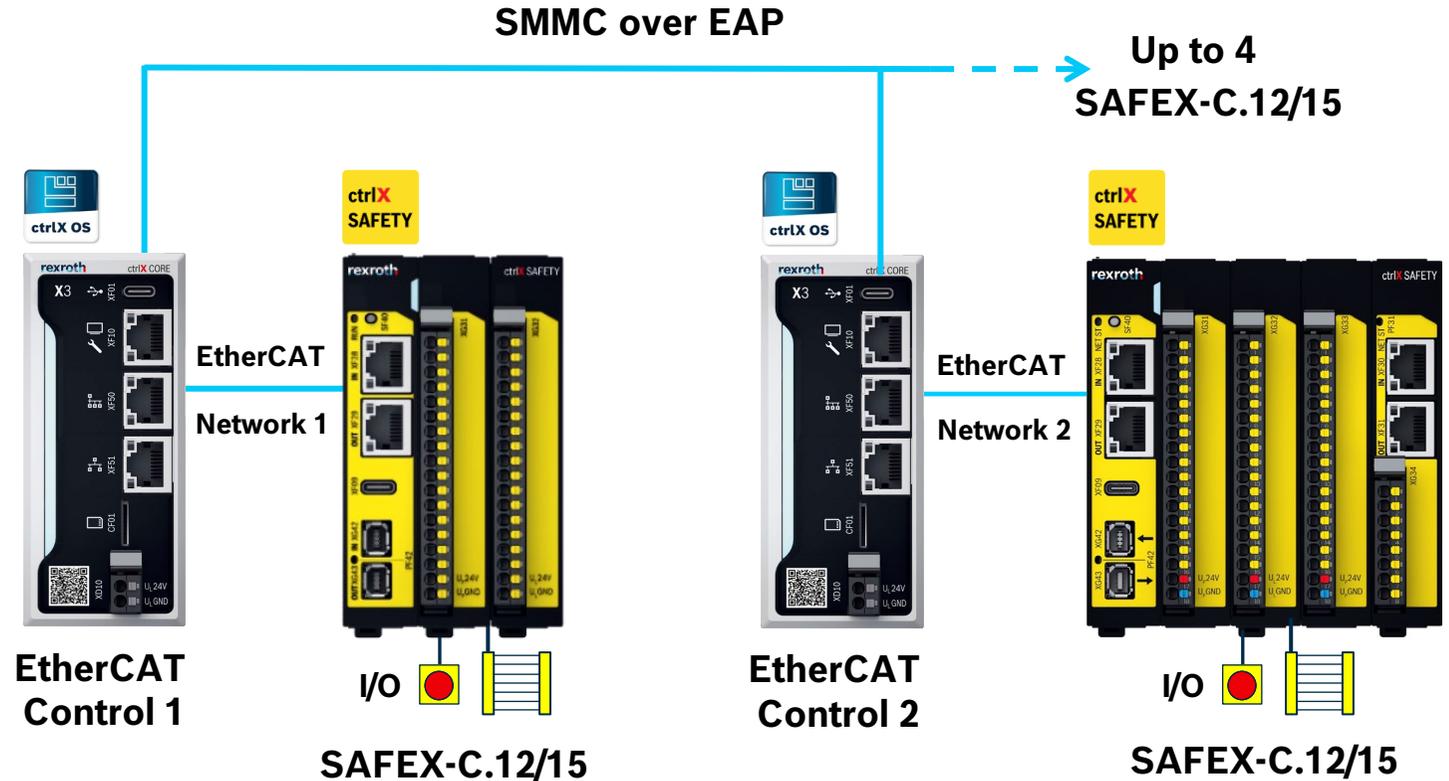**SAFEX-C.12/15 FSoE SubInstance**
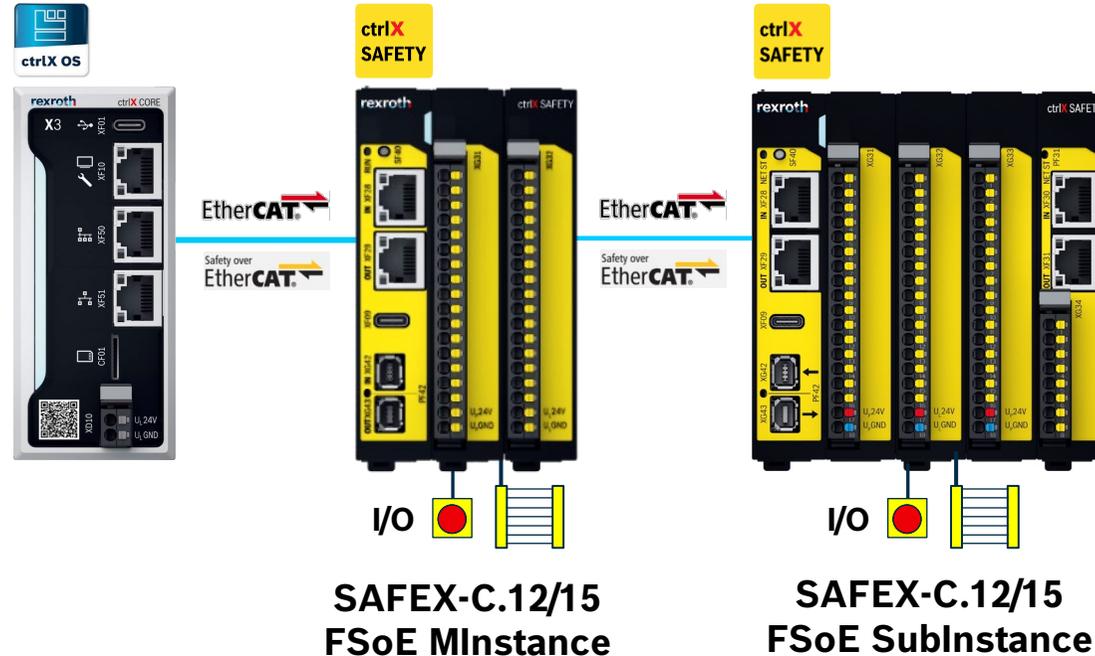
Up to 8* SAFEX-C.12/15

* Maximum FSoE data is 228 bytes. If other FSoE devices are used in the network this value is reduced

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How to determine which SAFEX safe data exchange should be used
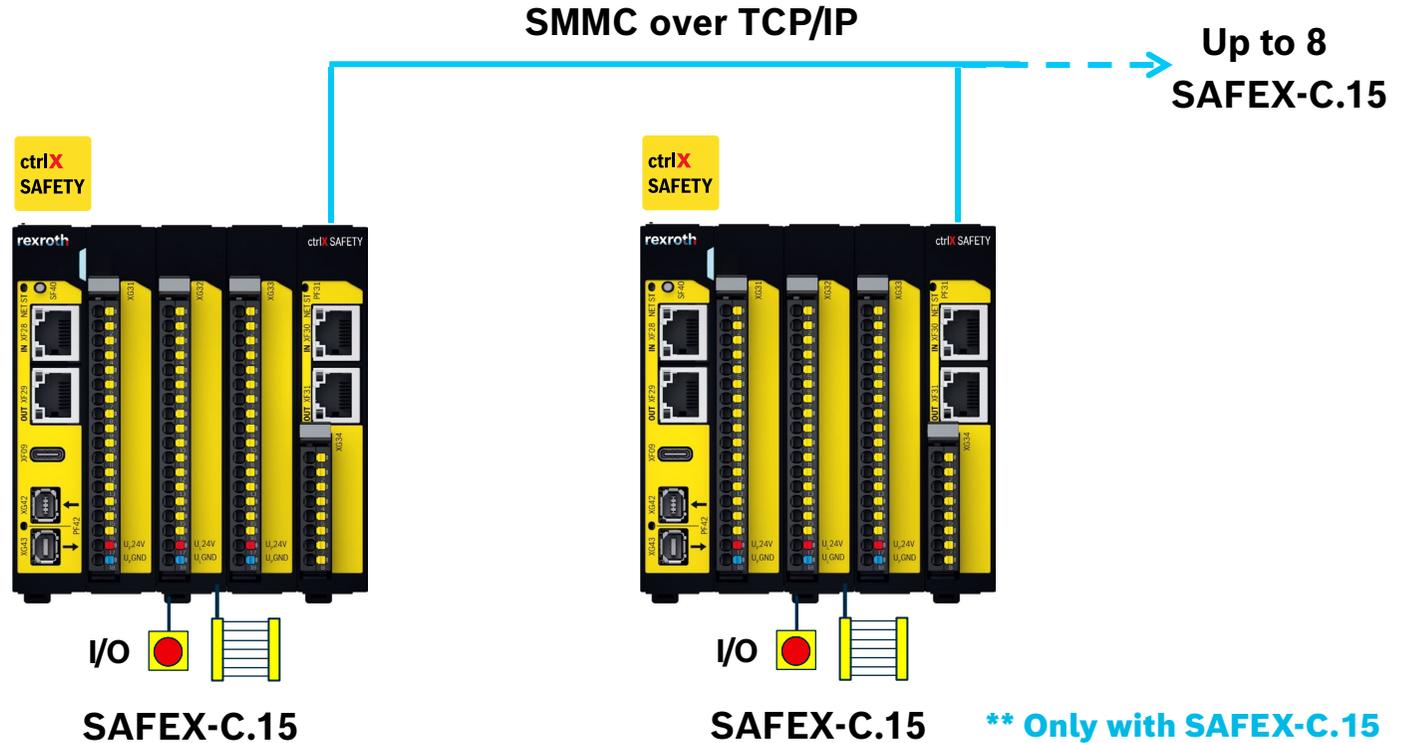# SAFEX-to-SAFEX safe data exchange Method #2 SMMC over EAP on Eth1

▶ Up to 4 **ctrlX SAFETY** controllers via **Safe-MInstance-to-MInstance-Communication (SMMC)** over **EtherCAT Automation Protocol (EAP)**

▶ Allows connection between different EtherCAT networks (**ctrlX CORE** /EtherCAT MInstance)

▶ 32 output bits per controller

▶ Participants can read all controller output bits (no passing of data through an EtherCAT controller)

▶ SMMC participant status can monitored

▶ Single **ctrlX SAFETY Engineering** Project for all SAFEX controllers

▶ **SMMC** between **ctrlX SAFETY** controllers **extends and scales capacity**

  ▶ in CPU power and

  ▶ Number of I/O

SMMC over EAP

Up to 4 SAFEX-C.12/15

EtherCAT Network 1

EtherCAT Network 2

EtherCAT Control 1

SAFEX-C.12/15

EtherCAT Control 2

SAFEX-C.12/15

I/O

I/O

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How to determine which SAFEX safe data exchange should be used
SAFEX-to-SAFEX safe data exchange Method #3 SMMC over TCP/IP on Eth2**

- Up to 8 **ctrlX SAFETY** controllers via **Safe-MInstance-to-MInstance-Communication (SMMC)** over **TCP/IP**

- Allows a standalone connection between SAFEX-C.15 controllers without an EtherCAT network or independent of the EtherCAT network

- 32 output bits per controller

- Participants can read all controller output bits (no passing of data through a controller)

- SMMC participant status can be monitored

- Single **ctrlX SAFETY Engineering** Project for all SAFEX controllers

- **SMMC** between **ctrlX SAFETY** controllers **extends and scales capacity**

  - in CPU power and

  - Number of I/O

SMMC over TCP/IP

Up to 8 SAFEX-C.15

I/O SAFEX-C.15

I/O SAFEX-C.15   ** Only with SAFEX-C.15

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How to determine which SAFEX safe data exchange should be used
SAFEX-to-SAFEX safe data exchange methods summary

	Method #1 FSoE	Method #2 SMMC over EAP	Method #3 SMMC over TCP/IP
EtherCAT network required?	Yes	Yes	No
SAFEX-C.1x in the same EtherCAT network (MInstance)?	Yes	No	N/A
Number of CORES?	1	>1	0
SAFEX-C.12 or SAFEX-C.15?	SAFEX-C.12 SAFEX-C.15	SAFEX-C.12 SAFEX-C.15	SAFEX-C.15 Only
Number of bits between SAFEX-C.12/15?	96	32	32
Number of SAFEX-C.1x Controls Connected?	8*	4	8
Direct SubInstance-to-SubInstance data exchange?	No	Yes	Yes
Number of ctrlX SAFETY Engineering Projects?	>1	1	1

* Maximum FSoE data is 228 bytes. If other FSoE devices are used in the network this value is reduced

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ctrlX SAFETY

Thank You!