# 28

# 28. SafetyPLC pro sběrnici EtherCAT

# 28.1 TwinCAT – tvorba SafetyPLC

#### 28.1.1 Zdrojové soubory ke stažení

TwinCAT2 zdarma ke stažení po registraci http://www.beckhoff.com/tcatweb/twincat\_download\_e.aspx

#### Nejnovější verze XML souboru periferií Beckhoff http://www.beckhoff.com/english/download/elconfg.htm

#### 28.1.2 Přiřazení jedinečných ID

Každá Safety periferie musí mít jedinečné ID na síti EtherCAT



| DIP switches |     |     |     |     |     | Addres |     |     |     |     |     |     |     |     |     |       |
|--------------|-----|-----|-----|-----|-----|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| 1            | 2   | 3   | 4   | 5   | 6   | 7      | 8   | 9   | 10  | 11  | 12  | 13  | 14  | 15  | 16  |       |
| ON           | OFF | OFF | OFF | OFF | OFF | OFF    | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 1     |
| OFF          | ON  | OFF | OFF | OFF | OFF | OFF    | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 2     |
| ON           | ON  | OFF | OFF | OFF | OFF | OFF    | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 3     |
| OFF          | OFF | ON  | OFF | OFF | OFF | OFF    | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 4     |
| ON           | OFF | ON  | OFF | OFF | OFF | OFF    | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 5     |
| OFF          | ON  | ON  | OFF | OFF | OFF | OFF    | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 6     |
| ON           | ON  | ON  | OFF | OFF | OFF | OFF    | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 7     |
| OFF          | OFF | OFF | ON  | OFF | OFF | OFF    | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | 8     |
|              |     |     |     |     |     |        |     |     |     |     |     |     |     |     |     |       |
| ON           | ON  | ON  | ON  | ON  | ON  | ON     | ON  | ON  | ON  | ON  | ON  | ON  | ON  | ON  | ON  | 65535 |

#### 28.1.3 Rozpoznání připojených periferií na EtherCATu

V levém okně projektu – pravé tlačítko myši – I/O Devices Zvolit Scan Devices...

Potvrdit a zvolit síťovou kartu, ke které jsou připojeny EtherCATové periferie.

|   | 2 new I/O devices found  |  |
|---|--|--|
| Device 1 (R1-Ethernet) [Pripojeni k mistri siti [Intel[R] PR0/1000 PL Netwo] OK<br>Device 3 (EtherCAT) [Pripojeni k mistri siti Ethercat (Intel[R] PR0/1000] Cancel<br>Select All<br>Unselect All | Device 1 (RT-Ethernet) [Připojení k místní síti (Intel(R) PR0/1000 PL Netwo] | OK<br>Cancel<br>Select All<br>Unselect All |

#### Rozbalit podsložku Term 1

#### 28.1.4 Tvorba SafetyPLC

Zvolit modul EL6900 – SafetyPLC Pravým tlačítkem zvolit – **Append TwinSAFE Group...** 

| 👺 Untitled - TwinCAT System Manager  |   |
|--|---|
| <u>File Edit Actions View Options Help</u>   |   |
| D 📽 📽 🖬 😹 🔥 👌 🕹 🕹 🕹 🕹 🕹  | 🗏 💼 🗸 🏄 👧 🧶 💱 🔨 🚳 🖹 🔍 🖓 👘 🍢 🕵 🖉 🦉   |
| SYSTEM - Configuration NC - Configuration PLC - Configuration I/O - Configuration I/O Devices Device 3 (EtherCAT) Device 3 (EtherCAT) Device 3 -Image Device 3-Image InfoData InfoData InfoData Term 1 (EK1101) Term 2 (EL2904) InfoData Term 5 (EL6900) Module 3 (FSOE) WcState Torm 5 (EL6900) Term 5 (EL6900) Term 5 (EL6900) Term 5 (EL6900) Term 7 (EL2008) Term 7 (EL2008) Term 7 (EL2008) Term 8 (EL9011) | General Input/Outputs   # 1 Dnline   Inputs RUN/STOP   ERR Ack Inputs   Outputs FB ERR   COM ERR Info Data   OUT ERR Info Data   Info Data Map Diag |
| Ready  | Local (192.168.255.215.1.1) Config Mode   |

Zvolit prvek **TwinSAFE Function Block List** Pravým tlačítkem zvolit – **Append Funtion Block** 

| Insert Function Block   |                           |
|---|---------------------------|
| Emergency Stop<br>Machine Monitoring<br>AND<br>OR<br>Decoupler<br>Operation Mode<br>Two Hand<br>EDM<br>Muting<br>RS<br>SR<br>TOF<br>TOF<br>TON<br>Connection Shutdown | OK<br>Cancel<br>Multiple: |

Vybrat například obsluhu Total Stopu – Emergency Stop

#### Přiřazení Safety vstupů



| unction Block Input Setti         | ngs                           | Function Block Input Settings   |                     |  |  |
|-----------------------------------|-------------------------------|---|---------------------|--|--|
| Channel Interface                 | EStopIn1                      | Channel Interface   | EStopIn1            |  |  |
|                                   | Make Contact (NO)             |   | O Make Contact (NO) |  |  |
| Single-Channel                    | EStopIn2<br>Make Contact (NO) | <ul> <li>● <u>Single-Channel</u></li> <li>✓ EStopIn1</li> <li>✓ EStopIn2</li> </ul> | EStopIn2            |  |  |
| O Two-Channel<br>Discrepancy Time | Break Contact (NC)            | O Two-Channel<br>Discrepancy Time   | Break Contact (NC)  |  |  |
| 100 ms                            | OK Cancel                     | 100 ms  | OK Cance            |  |  |

Dialog pro přidání vstupů se vyvolá kliknutím na ikonu kladiva a klíče vedle EStopIn.

Zvolíme požadovaný počet Total Stopových vstupů. Například 3. Nyní je postupně propojíme s jednotkou EL1904 TwinSAFE Input.

| EStopIn1 |
|----------|
| EStopIn2 |
| EStopIn3 |
| EStopIn4 |

Postupně Volíme EStopIn1... až EStopIn3...

U každého vstupu zvolíme TwinSAFE Input a tlačítko New

| king of EStopIn1        |                |
|-------------------------|----------------|
| ink Alias               |                |
| Linking of EStopIn1     |                |
|                         |                |
| Links                   |                |
| Position                | Channel   FSoE |
|                         |                |
|                         |                |
|                         |                |
| L                       | Charlist       |
|                         | Liear Link     |
| Insert New Link         |                |
| TwinSAFE Input          |                |
| O Function Block Output |                |
| 🔘 Standard Input        |                |
| N                       |                |
|                         | Close          |

#### Zvolíme požadovaný vstup



#### Přiřazení Safety výstupu

Výstupu Total Stopového EStopOut... obvodu propojíme se Safety vystupem EL2904



Dialog na přiřazení výstupů

| Linking of EStopOut                                   |              | Attach TwinSAFE Variable  | X            |
|---|--------------|---|--------------|
| Link Alias<br>Term 2 (EL2904).OutputChannel1<br>Links |              | Term 2 (EL2904)      UutputChannel1      OutputChannel2      OutputChannel3      OutputChannel4 | OK<br>Cancel |
| Position  | Channel FSoE |   |              |
|   | Clear Link   |   |              |
| Insert New Link                                       |              |   |              |
| TwinSAFE Dutput     Function Block Input              |              |   |              |
| Standard Output New                                   | Close        |   |              |

## Přiřazení signálu Restart

|                            | #1<br>Restart |
|----------------------------|---------------|
| Term 3 (EL1904).InputChann | EStopIn1      |
| Term 3 (EL1904).InputChann | EStopIn2      |
| Term 3 (EL1904).InputChann | EStopIn3      |
|                            | EStopIn4      |

Tlačítkem Restart ... vyvoláme dialog Linking of Restart

| king of Restart                           |     |                |
|---|-----|----------------|
| ink Alias                                 |     |                |
| Linking of Restart                        |     |                |
| inks                                      |     |                |
| Position                                  |     | Channel   FSoE |
|   |     |                |
|   |     |                |
|   |     | Clear Link     |
| nsert New Link                            |     |                |
| O TwinSAFE Input                          |     |                |
| <ul> <li>Function Block Output</li> </ul> |     |                |
|   |     |                |
| Standard Input                            | New |                |

Zvolíme Standart Input a tlačítko New.

Před volbou vstupu, který se připojí na Restart Total Stopového obvodu se nejprve **musí zrušit** volba **Exlude** same Image

| Attach Variable Standard In Var 1 (Output) |  |
|--|--|
|  | Show Variables   |
|  | Show Variable Types<br>Matching Type<br>Matching Size<br>All Types<br>Array Mode |
|  | Offsets  Continuous  Show Dialog   |
|  | Variable Name<br>Hand over<br>Take over  |
|  | Cancel OK  |

#### Zvolíme fyzický vstup na EL1008 bit2

| <ul> <li>I/O - Configuration</li> <li>I/O Devices</li> <li>Device 3 (EtherCAT)</li> <li>Term 2 (EL2904)</li> <li>↑ WcState &gt; IX 1522.1, BIT [0.1]</li> <li>↑ InputToggle &gt; IX 1524.1, BIT [0.1]</li> <li>Term 3 (EL1904)</li> <li>↑ InputChannel1 &gt; IX 48.0, BIT [0.1]</li> <li>↑ InputChannel2 &gt; IX 48.0, BIT [0.1]</li> <li>↑ InputChannel3 &gt; IX 48.2, BIT [0.1]</li> <li>↑ InputChannel4 &gt; IX 48.3, BIT [0.1]</li> <li>↑ Input &gt; IX 89.0, BIT [0.1]</li> <li>↑ Input &gt; IX 89.2, BIT [0.1]</li> <li>↑ Input &gt; IX 89.3, BIT [0.1]</li> <li>↑ Input &gt; IX 89.3, BIT [0.1]</li> <li>↑ Input &gt; IX 89.4, BIT [0.1]</li> <li>↑ Input &gt; IX 89.5, BIT [0.1]</li> <li>↑ Input &gt; IX 89.5, BIT [0.1]</li> <li>↑ Input &gt; IX 89.7, BIT [0.1]</li> </ul> | <ul> <li>Show Variables</li> <li>Unsed</li> <li>Uged and unused</li> <li>Exclude disabled</li> <li>Exclude same Image</li> <li>Show Variable Types</li> <li>Matching Type</li> <li>Matching Type</li> <li>All Types</li> <li>Array Mode</li> <li>Offsets</li> <li>Continuous</li> <li>Show Dialog</li> <li>Variable Name</li> <li>Hand over</li> <li>Take over</li> </ul> |
|--|---|

| Úsněšně | nřin | oiený | fyzický | vstun | na Restar | t |
|---------|------|-------|---------|-------|-----------|---|
| Ospesne | prip | ojeny | TYZICKY | vstup | na restar | l |

| nking of Restart               |                                    |              |
|--------------------------------|------------------------------------|--------------|
| Link Alias                     |                                    |              |
| Input                          |                                    |              |
|                                |                                    |              |
| Links                          |                                    |              |
| Position                       |                                    | Channel FSoE |
| Input . Channel 3 . Term 6 (EL | .1008) . Device 3 (EtherCAT) . 1/( | 0            |
|                                |                                    |              |
|                                |                                    |              |
|                                |                                    |              |
|                                |                                    | Clear Link   |
|                                |                                    |              |
| Insert New Link                |                                    |              |
| TwinSAFE Input                 |                                    |              |
| O Function Block Output        |                                    |              |
| 🚫 Standard Input               |                                    |              |
|                                |                                    |              |
|                                | New                                | Church       |

Přiřazené fyzické vstupy zobrazené u funkčního bloku SafetyPLC

| Input                      | #1<br>Restart |
|----------------------------|---------------|
| Term 3 (EL1904).InputChann | EStopIn1      |
| Term 3 (EL1904).InputChann | EStopIn2      |
| Term 3 (EL1904).InputChann | EStopIn3      |
|                            | EStopIn4      |

| 🁺 Untitled - TwinCAT System Manager   |   |  |
|---|---|--|
| <u>File Edit Actions View Options Help</u>  |   |  |
| D 📽 🖬 😹 🗛 👌 月   | u 💼 🗸 🏙 👧 👧 🎨 🔨 🚳 🖻 Q, 🖓 66' 🔍 💕 🧶 🖾 .  | ?  |
| Image: SystEM - Configuration         Image: SystEM - Configuration </th <th>General Input/Outputs          General Input/Outputs         #1         Inputs         ERR Ack         Outputs         FB ERR         OUT ERR         OUT ERR         Imap Diag</th> <th></th> | General Input/Outputs          General Input/Outputs         #1         Inputs         ERR Ack         Outputs         FB ERR         OUT ERR         OUT ERR         Imap Diag |  |
| Ready   |   | Local (192, 168, 255, 215, 1, 1) Config Mode |
| Vatuov  |   |  |

#### Přiřazení základních ovládacích signálů

RUN/STOP Vstup na EL1008 bit0 ErrAck Vstup na EL1008 **bit1** 

#### Výstupy

Výstup na EL2008 bit3(Nejméně jeden funkční blok je chybný) FB ERR COM ERR Výstup na EL2008 bit4 (Nejméně jedno spojení skupiny je chybné) OUT ERR Výstup na EL2008 bit5(Chyba výstupů (EL6900 nemá lokální výstupy))

| 👺 Untitled - TwinCAT System Manager  |  |        |
|--|--|--------|
| <u>File Edit Actions View Options Help</u>   |  |        |
| ] D 😅 📽 🖬 🚑 D, X 🖻 📾 🚑 🗛 🡌 🤅   | ≞ == ✓ # @ @ \$≥ << @ \$≥ = Q 2 60 9 2 0 8   |        |
| SYSTEM - Configuration         IV - Time S (ELSON)         IV - Time S (ELSON) | Eereral hput/Outputs     FB ER Output     Outpu |        |
| Ready  | Local (192.168.255.215.1.1) Confi  | g Mode |

#### 28.1.5 Nahrát SafetyPLC do EL6900

Nejprve je třeba poznamenat si Serial Number modulu EL6900

| 🖌 TwinSAFE.tsm - TwinCAT System Manager  | ×    |
|--|------|
| Ele Edit Actions View Options Help   |      |
| D 🖆 🖬 🗐 🕃 👗 ங 🗟 📾 🤌 🖲 🔜 🐽 🗸 🏙 🏨 🌺 🌺 🌺 🌺 🏷 🚳 🐂 🔍 🖉 🛷 🗐 🐒  |      |
| PLC - Configuration         I/O - Configuration         I/O - Configuration         I/O - Configuration         I/O - Device 3 (Ether CAT)         Device 3 (Ether CAT) <th></th> |      |
| Server (Part) Timestamp Message  |      |
| TwinCAT Syst         19.3.2014 9:50:48 546 ms         TCICC Server started: TCPLC.           TwinCAT Syst         19.3.2014 9:50:48 531 ms         TCIOPNET Server started: TCIOPNET.           TwinCAT Syst         19.3.2014 9:50:48 515 ms         TCIOECAT Server started: TCIOECAT.           TwinCAT Syst         19.3.2014 9:50:48 500 ms         TCIOETH Server started: TCIOECAT.   |      |
| Local (192. 168.255.215.1.1) Config Mode   | .sti |

#### Zvolit záložku TwinSAFE Verifier a začít nahrávání tlačítkem Download

| TwinSAFE.tsm - TwinCAT System Manager  |  |
|--|--|
| <u>File Edit Actions View Options H</u> elp  |  |
| D 📽 📽 🖬 🗇 B. X Pa Ra 🔉 M 8 🔒   | ¦ == ✓ ∰ 👧 象 🔆 🦄 😵 🖹 Q 🖓 & 🔍 👷 🖉 🧶   |
| PLC - Configuration<br>PLC - Configuration<br>Device 3 (EtherCAT)<br>Device 3 (EtherCAT)<br>Device 3 -Image<br>Device 3-Image<br>Device 3- | General EtherCAT Process Data Startup CoE - Online Online TwinSAFE Logic TwinSAFE Verifier          Initializing         Getting adjusted language from host DK!         Loading language library Failed!         Determining version information DK!         Ready. |
| InfoData     TwinSAFE Group 1     TwinSAFE Function Block List     Emergency Stop (FB 1)     Emergency Stop (FB 1)     Term 6 (EL 1008)     Term 7 (EL 2008)   | Version 1.6, Build 1   |
| Server (Port) Timestamp Message  |  |
| TwinCAT Syst 19.3 2014 9:50:48 546 ms TCPLC Serve  | ar startad: TCPI C   |
| TwinCAT System 19.3.2014 9:50:48 540 ms TCIOPNET S   | erver started: TCIOPNET.   |
| TwinCAT Syst 19.3.2014 9:50:48 515 ms TCIOECAT S   | erver started: TCIOECAT.   |
| TwinCAT Syst 19.3.2014 9:50:48 500 ms TCIOETH Se   | rver started: TCIOETH.   |
| Ready  | Local (192.168.255.215.1.1) Config Mode  |

#### Vyplnit dialog (výchozí heslo je: TwinSAFE)

| Login      |               |
|------------|---------------|
| User Name: | Administrator |
| Serial No. | 00548112      |
| Password:  | ******        |
|            | OK Cancel     |

Souhrn parametrů, které se nahrají přímo do modulu SafetyPLC

| P | roject  |   |
|---|---|---|
|   | Function Blocks: 1<br>Mapped Outputs: 3   | > |
|   | Detailed project configuration:<br>* TwinSAFE Group 1 (1 FB(s), 1 Connection(s))<br>RUN/STOP is linked to StandardIn 1.1.<br>ERB_ACK is linked to StandardIn 1.2.<br>* TwinSAFE Connection 1 (This term is master.)<br>Associating term is "EL1904".<br>FSOE Address of associating term = 3, Connection-Id = 1, Watchdog = 100 ms, SIL = 2.<br>Parameter:  |   |
|   | Operating Mode (Index #x8000:1) is digital<br>Sensor test Channel 1 active (Index #x8001:1) is true<br>Sensor test Channel 2 active (Index #x8001:2) is true<br>Sensor test Channel 3 active (Index #x8001:3) is true<br>Sensor test Channel 4 active (Index #x8001:4) is true<br>Logic of Channel 1 and 2 (Index #x8002:1) is single logic channel 1/2<br>Logic of Channel 3 and 4 (Index #x8002:3) is single logic channel 3/4<br>Store Code (Index #x10E0:1) is 0x0<br>Project CRC (Index #x10E0:2) is 0x0 |   |
|   | * TwinSAFE Function Block #1 (Emergency Stop)<br>Restart is linked to StandardIn 1.0.<br>EStopIn1 (Break Contact) is linked to TwinSAFE Connection 1 (ConnId = 1), Channel 1.<br>EStopIn2 (Break Contact) is linked to TwinSAFE Connection 1 (ConnId = 1), Channel 2.<br>EStopIn3 (Break Contact) is linked to TwinSAFE Connection 1 (ConnId = 1), Channel 3.   |   |
|   | * Mapped TwinSAFE Outputs<br>TwinSAFE Group 1, output FB ERR is linked to StandardOut 1.0,<br>TwinSAFE Group 1, output COM ERR is linked to StandardOut 1.1,<br>TwinSAFE Group 1, output OUT ERR is linked to StandardOut 1.2.  |   |
|   | Save Print Cancel Start   |   |

#### Znovu zadat heslo TwinSAFE

| Login      |               |
|------------|---------------|
| User Name: | Administrator |
| Serial No. | 548112        |
| Password:  |               |
|            | OK Cancel     |





Uložit soubor mezi slave-ové komunikace S2S.xml

# 28.2 KPA EtherCAT Studio

#### 28.2.1 Zdrojové soubory ke stažení

EtherCAT Studio verze 1.12.88.0 a vyšší (pro stažení je nutná registrace) https://koenig-pa.com/?p=downloads&ip=ethercat\_studio

#### 28.2.2 Tvorba projektu

- Vytvořit nový projekt
- Scan periferií
- V modulu EL6900 záložka FMMU/SM Upload from slave zaškrtnout PDO configuration
- Potvrdit volbo pomocí připojení k cílovému masteru (Attach Master)

| II Slave 1 (EK1101)<br>⊕ 🔚 ID | Sync Managers conf                                     | guration<br>P. start                 | Length                    | Data   |
|-------------------------------|--|--------------------------------------|---------------------------|--|
|                               | SM0:MBoxOut<br>SM1:MBoxIn<br>SM2:Outputs<br>SM3:Inputs | 0x1000<br>0x1100<br>0x1200<br>0x1200 | 256<br>256<br>2<br>2<br>2 | 0x26000100<br>0x22000100<br>0x24000100<br>0x20000100 |
|                               | Cedit Sync Mana  | ger                                  |                           |  |
|                               | PDO assignment   |                                      | Dow                       | nload to slave                                       |
|                               |  |                                      | F                         | PDO assignment<br>PDO configuration                  |
|                               |  |                                      | Uplo                      | ad from slave  |

#### 28.2.3 Načtení S2S komunikace

Zvolíme odpojení od cílového masteru (**Detach Master**) Menu Tools – S2S Communication Editor

| Master: Master 1 Mode: via Master V<br>Outputs<br>Slave: All Channel: Via Master V<br>Master 1<br>Master 1<br>Master 1<br>Channel: Via Master 1<br>Master 2 (EL2904)<br>Master 3 (EL1904)<br>Master 2 (EL2904)<br>Master 2 (EL2904)<br>Mast | 1. 1.0.02.0 |
|--|-------------|
| Outputs     Inputs       Slave:     All     Channel:       Imputs     Imputs     Slave:     All       Imputs     Imputs     Slave:     All       Imputs     Imputs     Slave:     All       Imputs     Imputs     Imputs     Imputs       Imputs     Imputs     Imputs       Imputs     Imputs   |             |
| Slave:       All       Channel:         Image: Master 1       Image: Master 1       Image: Master 1         Image: Master 1       Image: Master 1       Image: Master 1         Image: Master 1       Image: Master 1       Image: Master 1         Image: Master 1       Image: Master 1       Image: Master 1         Image: Master 2 (EL2904)       Image: Master 2 (EL2904)       Image: Master 2 (EL2904)         Image: Image: Master 3 (EL1904)       Image: Image: Master 3 (EL1904)       Image: Imag  |             |
| Image: Master 1  | ~           |
|  | ~           |
| Inputs Bit offset Bit length   |             |

Importujeme vytvořený soubor S2S komunikace pomocí TwinCATu. Stiskneme tlačítko **Import connections from ENI** 

| Communication Iaster: Master 1  Mode: via Master   |  | Plug-in version: 1.0.32 |
|--|--|-------------------------|
| Dutputs  | Inputs   |                         |
| Slave: All 🗸 Channel:  | Slave: All   | Channel:                |
| Master 1     Slave 1 (EK1101)     Slave 2 (EL2904)     G Outputs (48 bits)     D Outputs (16 bits)     Slave 3 (EL1904)     Slave 4 (EL1018)     Slave | Master 1<br>Slave 1 (EK1101)<br>Slave 2 (EL2904)<br>Slave 2 (EL2904)<br>Slave 3 (EL1904)<br>Slave 3 (EL1904)<br>Slave 4 (EL1018)<br>Channel 1 (1 bits)<br>Channel 1 (1 bits) | s)                      |
| nouts  | Bit offset   | Bit length              |
| Slave 5 (EL6900) Module 2 (FSOE Slave Frame Elements ConnID 0002)  | 0xA8   | 48                      |
| Slave 2 (EL2904).Outputs   | 0x0  | 48                      |
| 🛛 ⊑ Slave 5 (EL6900).Module 1 (FSOE Slave Frame Elements ConnID 0001)  | 0x78   | 48                      |
| Slave 3 (EL1904).FSOE  | 0x40   | 48                      |
| Slave 3 (EL1904).FSOE  | 0x40   | 48                      |
| Slave 5 (EL6900).Module 1 (FSOE Slave Frame Elements ConnID 0001)  | 0x70   | 48                      |
| Slave 2 (EL2904).Inputs  | 0x10   | 48                      |
| Slave 5 (EL6900).Module 2 (FSOE Slave Frame Elements ConnID 0002)  | UXAD   | 48                      |
| Slave 6 (EL 1006).Channel 5.input  |  | 1                       |
| Slave 5 (El 6900) Input SubIndex 001   | 0xD8   | 1                       |
| Slave 7 (EL2008).Channel 4.Output  | 0xEB   | 1                       |
| - 🖛 Slave 5 (EL6900).Input.SubIndex 002  | 0xD9   | 1                       |
| Slave 7 (EL2008).Channel 5.Output  | 0xEC   | 1                       |
| - 🖛 Slave 5 (EL6900).Input.SubIndex 003  | 0xDA   | 1                       |
| → Slave 7 (EL2008).Channel 6.Output  | 0xED   | 1                       |
| Slave 6 (EL1008).Channel 1.Input   | DXFU   | 1                       |
| Slave 5 (EL6900).Output.Subindex 002   | 0xD1   | 1                       |
| Slave 5 (EL6900).Output.SubIndex 003   | 0xD2   | 1                       |
|  |  |                         |

Potvrdíme OK a konfiguraci nahrajeme pomocí Attach Master

#### 28.2.4 Přidání nový periferií do projektu

Po přidání nových periferií do projektu EtherCAT Studia je třeba: V modulu EL6900 – záložka FMMU/SM – Upload from slave – zaškrtnout **PDO configuration** Potvrdit pomocí **Attach Master** Zvolit **Detach Master** Menu Tools – **S2S Communication Editor** Vymazat a znovu vytvořit 4 následující propoje:

- EL6900.Module 1 (FSOE Slave Frame Elements ConnID 0001)
  - → EL1904.Module\_0\_Output
- EL1904.Module\_0\_Input
  - → EL6900.Module 1 (FSOE Slave Frame Elements ConnID 0001)
- EL2904.Module\_0\_Input
  - → EL6900.Module 1 (FSOE Slave Frame Elements ConnID 0002)
- EL6900.Module 1 (FSOE Slave Frame Elements ConnID 0002)
   → EL2904.Module\_0\_Output

Ukončit dialog S2S pomocí OK

Potvrdit pomocí Attach Master

#### 28.2.5 Ověření činnosti SafetyPLC





State 3, State 4 a Diag 1 svití trvale Diag 4 bliká 2x krátce – chyba komunikace Safety PLC Při přechodu do režim **Operation** se rozvítí **State 1** a **State 2** 

| Slave 1 (EK1101)     | Output variables |        |      |          |       |
|----------------------|------------------|--------|------|----------|-------|
|                      | Channel          | Name   | Туре | Bit size | Value |
| • port: K (E-Bus)    | Channel 1        | Output | BOOL | 1        | 0     |
|                      | Channel 2        | Output | BOOL | 1        | 0     |
| 🗄 🕤 Slave 3 (EL1904) | Channel 3        | Output | BOOL | 1        | 0     |
| 🗄 📲 Slave 4 (EL1018) | Channel 4        | Output | BOOL | 1        | 0     |
| 🗄 🕤 Slave 5 (EL6900) | Channel 5        | Output | BOOL | 1        | 1     |
| 🗄 📲 Slave 6 (EL1008) | Channel 6        | Output | BOOL | 1        | 0     |
| Slave 7 (EL2008)     | Channel 7        | Output | BOOL | 1        | 0     |
|                      | Channel 8        | Output | BOOL | 1        | 0     |
|                      |                  |        |      |          |       |

Channel 5 je chyba komunikace SafetyPLC Nastavíme Channel 1 na 1 – **RUN/STOP...** Nastavíme Channel 2 na 1 – **ERR ACK...** měla by přestat blikat LED diag 4 a Channel 5(SafetyCommunicationErr) by se měl změnit na 0

Nastavíme Channel 2 na 0 – ERR ACK...

Nastavíme Channel 3 na 1 – **Restart...** 

Nastavíme Channel 3 na 0 – Restart...

Nyní by mělo SafetyPLC sepnout Safety výstup a při stisku Total Stopu ho okamžitě vypnout nezávisle na systému.

#### EL1900 – Modul výstupů





#### EL2900 – Modul vstupů

**Diag 2 svítí trvale červeně** - zkrat nebo externí napájení. Tato chyba vzniká také v případě, pokud je připojeno točítko, musí se použít relé mezi točítkem a safety vstupem. Zapojení relé podle nádsledujícího schématu (Připojení točítka k bezpečnostnímu modulu Beckhoff)

#### Schéma zapojení pomocného relé mezi total stopem točítka a safety vstupem



# 28.3 WinCNC – PLC

Hlavní obsluha SafetyPLC ze systému WinCNC

#### 28.3.1 Hlavní obsluha – Main.plc

| MECH_BEGIN | mTotalStop         |                                    |  |  |
|------------|--------------------|------------------------------------|--|--|
| - FL       | 1,outSafetyRun     | ;Zapnutí Safety periferií          |  |  |
| FL         | 1,outSafetyErrAck  | ;Potvrdit chybový vstup            |  |  |
| EX         |                    |                                    |  |  |
| FL         | 0,outSafetyErrAck  |                                    |  |  |
| FL         | 1,outSafetyRestart | ;Restart funkčních bloků SafetyPLC |  |  |
| EX         |                    |                                    |  |  |
| FL         | 0,outSafetyRestart |                                    |  |  |
| MECH_END   | mTotalStop         |                                    |  |  |

#### MODULE\_INIT

| DEF_IN inSafetyFunctionBlockH<br>DEF_IN inSafetyCommunicationH<br>DEF_IN inSafetyOutputErr,<br>DEF_IN inSafetyBezpDvereVprec<br>DEF_IN inSafetyBezpDvereZasoh | Err,<br>Err,<br>du,          | 'SafetyFunctio<br>'SafetyCommuni<br>'SafetyOutputE<br>'SafetyBezpDve<br>'SafetyBezpDve | nBlockErr',<br>cationErr',<br>rr',<br>reVpredu',<br>reZasobnik', | TYPE_BIT<br>TYPE_BIT<br>TYPE_BIT<br>TYPE_BIT<br>TYPE_BIT |
|---|------------------------------|--|--|--|
|   | )111 K,                      | Salecybezpbve  | 1020300011K ,  |  |
| DEF OUT outSafetyRun,   | 'Safe                        | tyRun',  | TYPE BIT   |  |
| DEF_OUT outSafetyErrAck,  | 'Safe                        | tyErrAck',   | TYPE_BIT   |  |
| DEF_OUT outSafetyRestart,   | 'Safe                        | tyRestart',  | TYPE_BIT   |  |
| ;Safety - Nejméně jeder<br>EDEF -, inSafetyFunctionBloc<br>;Safety - Nejméně jedno<br>EDEF -, inSafetyCommunicatio  | n funkč<br>ckErr,<br>o spoje | ní blok je chył<br>Err_SafetyFunc<br>ní TwinSAFE sku<br>Err SafetyComm                 | oný.<br>tionBlock,<br>upiny je chybné<br>unicationErr.           | -,1001b  |
| ;Safety - Chyba výstupů   | i (EL69                      | 00 nemá lokálni  | výstupy).  | ,10010   |
| EDEF -, inSafetyOutputErr,<br>;Safety - Bezpečnostní  | dveře                        | Err_SafetyOutp<br>vpředu otevřeny  | utErr,<br>/·   | -,1001b  |
| EDEF -, inSafetyBezpDvereVpr<br>;Safety - Bezpečnostní  | redu,<br>dveře               | Err_SafetyBezp<br>zásobníku otevi  | DvereVpredu,<br>řeny.  | -,1001b  |
| EDEF -, inSafetyBezpDvereZas  | sobnik,                      | Err_SafetyBezp   | DvereZasobnik,   | -,1001b  |
| MODULE INIT END   |                              |  |  |  |

### 28.3.2 Vstupy a výstupy – InOuts.ChannelConfig

```
<!-- Safety moduly a jejich obsluha
- SafetyOutput 1 (2904) - Vstup TotalStop
- SafetyInput 2 (1904) - Výstup stykače
- SafetyPLC 20 (6900) - SafetyPLC
- Input
               21 (1008) - Diagnostika od SafetyPLC
      - Fyzické propoje
      - Input 21.1 ↔ Output 22.1
      - Input 21.2 ↔ Output 22.2
      - Input 21.3 ↔ Output 22.3
      - Input 21.4 ↔ Output 23.1
      - Input 21.5 \leftrightarrow Output 23.2
      - Input 21.6 ↔ Output 23.3
      - Input 21.7 ↔ Output 23.4
      - Input 21.8 ↔ Output 23.5
- Output
                  22 (2008) - Obsluha pomocí PLC
- Output
                  23 (2008) - Obsluha pomocí SafetyPLC
<Connection
                  Source="ECAT.Input21.Channel 1.Input"
                  Destination="SafetyPLC - Input SafetyRun"
            Connected="0"></Connection>
                 Source="ECAT.Input21.Channel 2.Input"
<Connection
                  Destination="SafetyPLC - Input SafetyErrAck"
            Connected="0"></Connection>
                  Source="ECAT.Input21.Channel 3.Input"
<Connection
                  Destination="SafetyPLC - Input SafetyRestart"
            Connected="0"></Connection>
-->
<Connection
                  Source="ECAT.Input21.Channel 4.Input"
                  Destination="PLC.Input.SafetyFunctionBlockErr"
            Connected="1"></Connection>
                  Source="ECAT.Input21.Channel 5.Input"
<Connection
                  Destination="PLC.Input.SafetyCommunicationErr"
            Connected="1"></Connection>
                  Source="ECAT.Input21.Channel 6.Input"
<Connection
                  Destination="PLC.Input.SafetyOutputErr"
            Connected="1"></Connection>
                  Source="ECAT.Input21.Channel 7.Input"
<Connection
                  Destination="PLC.Input.SafetyBezpDvereVpredu"
            Invert="1" Connected="1"></Connection>
                  Source="ECAT.Input21.Channel 8.Input"
<Connection
                  Destination="PLC.Input.SafetyBezpDvereZasobnik"
            Invert="1" Connected="1"></Connection>
<Connection
                  Source="PLC.Output.SafetyRun"
            Destination="ECAT.Output22.Channel 1.Output"
     Connected="1"></Connection>
                  Source="PLC.Output.SafetyErrAck"
<Connection
                  Destination="ECAT.Output22.Channel 2.Output"
            Connected="1"></Connection>
                 Source="PLC.Output.SafetyRestart"
<Connection
            Destination="ECAT.Output22.Channel 3.Output"
     Connected="1"></Connection>
```

```
<!--
                Source="SafetyPLC - Output SafetyFunctionBlockErr"
<Connection
          Destination="ECAT.Output23.Channel 4.Output"
     Connected="0"></Connection>
                Source="SafetyPLC - Output SafetyCommunicationErr"
<Connection
          Destination="ECAT.Output23.Channel 5.Output"
     Connected="0"></Connection>
                Source="SafetyPLC - Output SafetyOutputErr"
<Connection
           Destination="ECAT.Output23.Channel 6.Output"
     Connected="0"></Connection>
                Source="SafetyPLC - Output SafetyBezpDvereVpredu"
<Connection
          Destination="ECAT.Output23.Channel 7.Output"
     Connected="0"></Connection>
                Source="SafetyPLC - Output SafetyBezpDvereZasobnik"
<Connection
          Destination="ECAT.Output23.Channel 8.Output"
     Connected="0"></Connection>-->
```