TechTip: Procedure at unknown PLC cards

Contents

1. General

Already today the EPLAN Data Portal supplies a multitude of manufacturer information and part macros. Nevertheless, It is possible that a used PLC card is not available there.

This TechTip helps you to create parts and macros for your PLC devices in such a manner that they can be reused easily.

For the fundamental description of a property please refer to the EPLAN help of Version 2.8:

- Terminals, Cables, Plugs, and PLC Information > PLC > Basics

- EPLAN Properties: Overview

You can also find further notes and specifications on individual properties in the

- "TechTip: Overview of the PLC properties"

Information for reading

Structure of the individual tables:

Property	<ID>
Input format	
Special features	

2. Parts management

In the parts management you already specify in advance the properties of the PLC device or a bus-compatible device that do not change in your project (*fixed and device-dependent data*). These data are transferred from here to your project at a part or device selection.

The following tabs, amongst others, are available to you to enter PLC-relevant data:

- Properties
- Function templates.

2.1. Tab Properties

Node **PLC data**

PLC type designation	22105
String	
The value has to be filled in at all the PLC cards or bus-compatible devices if the "Device description: File name" is not filled. *As a rule the original order number under observance of any blanks and separators is to be specified.*	

Device description: File name	22037
File name of the device description file with file name extension and without file path specification	
The value has to be filled at all the PLC cards or bus-compatible devices if the "PLC type designation" is not filled. *Is used together with Device description: Index in file.*	

Device description: Index in file	22283
Numerical reference to the device in the file specified by means of *Device description: File name*	
Is used together with Device description: File name.	

Detailed information about using **PLC type designation**, **Device description: File name** and **Device description: Index in file** is available in the EPLAN help system in the section "Data exchange of PLC configuration files" under the keyword "Device identification".

Object description	22038
Any string	
Designation of the PLC box.	

Version	22104
Any string	

Address range (SIEMENS STEP 7 Classic), Address range 2 (SIEMENS STEP 7 Classic)	22106, 22261
Numerical value	
Address range: Specification for inputs. *Can also be used for outputs if the card only has outputs.* *Address range 2: Specification for outputs.* *Is only used at SIEMENS STEP 7 Classic and, depending on the PLC card, determines the number of input / output bits or bytes.*	

PLC device: Data length (inputs), PLC device: Data length (outputs)	20571, 20573
Numerical value	
Number of the occupied bits for the inputs or outputs of the PLC card. *This property is only used for check runs which refer to the address range of PLC cards.*	

A PLC card can consist of several integrated modules (subdevices) that each have separate Address ranges and start addresses. Each subdevice is defined by corresponding properties. Up to twelve subdevices can be specified (in the text below x designates the number of the subdevice 1…12).

Subdevices do not have their own **PLC type designation** or specifications on a device description file and are exported when they have at least one start address.

Note: If a PLC card does not have subdevices (meaning that it only consists of one module), the corresponding definitions can be omitted. The value "0" or "1" is entered (both values have the same meaning) at the **PLC subdevice: Index** property at the associated PLC connection points.

Further information on the definition of subdevices is available from your PLC manufacturer.

PLC subdevice x: Name	22293 ff.
Any string	

PLC subdevice x: Position (slot / module)	22305 ff.
Numerical value	

PLC subdevice x: Data length (inputs), **PLC subdevice x: Data length (outputs)**	**20572 ff.,** **20574 ff.**
Numerical value	
Number of the occupied bits for the inputs or outputs of the PLC card. *This property is only used for check runs which refer to the address range of PLC cards.*	

PLC station type	**22269**
String, depending on the target system	
The value has to be filled in at each PLC box that represents a CPU or a head station or is a bus-compatible device.	

Bus coupler / head station	**22019**
Check box	
All PLC boxes or bus-compatible devices that represent a bus coupler or a head station have to be identified by activating the check box.	

CPU	**22020**
Check box	
All PLC boxes or bus-compatible devices that represent a CPU have to be identified by activating the check box.	

Power supply	**22052**
Check box	
All PLC boxes or bus-compatible devices that represent a power supply have to be identified by activating the check box.	

Bus distribution device	**22053**
Check box	
All PLC boxes or bus-compatible devices that represent a bus distribution device have to be identified by activating the check box.	

PLC card is placed on head station	**22290**
Check box	
AML format: Identifies a PLC card that is placed on a head station or is integrated into it and is not adjoined next to the head station.	

2.2. Tab Function templates

2.2.1. Specifying function definitions

The compilation of function templates is often seen as the most difficult part. However, it is easy to handle if you stick to certain rules and procedures.

Currently different function definitions are available under the **PLC connection point** group that are divided in different groups:

- Graphic
- 2 connection points
- Power supply unit, 1 connection point
- I/O, 1 connection point
- Card power supply, 1 connection point
- Network / bus cable
- Variable.

A function definition is assigned to each PLC connection point. However, this is not possible if the relevant module is not known. Therefore, it is necessary to obtain the data sheet of the module from the manufacturer. Reference to the hardware catalog or the corresponding device manual (in many cases available as a download from the manufacturer site) can help.

In the following example the procedure is shown as an example. An analog module of SIEMENS (6ES7331-7HF0x-0AB0: SM 331: AI 8 x 14 bits) is used.

Data sheet extract of manufacturer
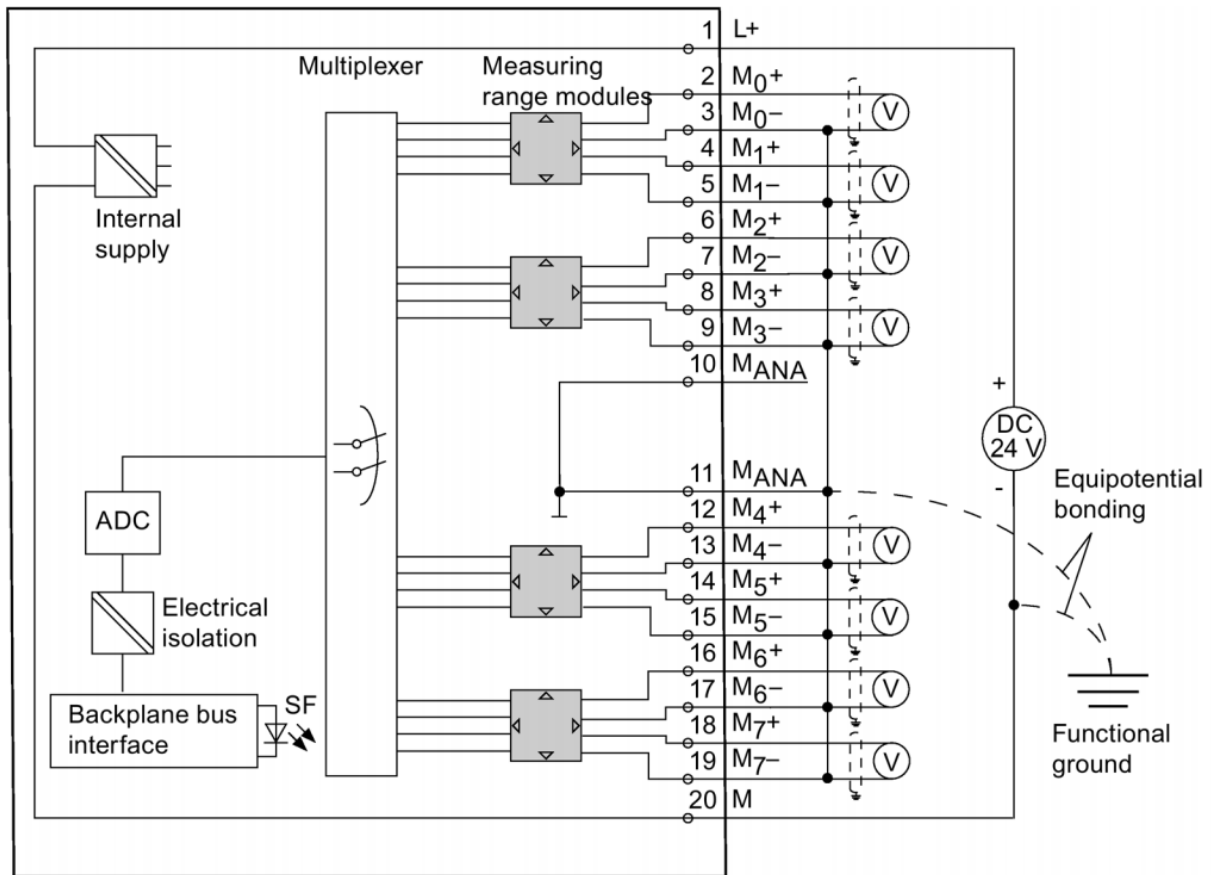
Identifying channel-independent connection points

Channel-independent connection points are all connection points that cannot be assigned directly to one individual channel. These are

- Card power supplies

- Power supplies that are used for more than one channel.

Use the function definition from the **Card power supply, 1 connection point** group for these connection points.
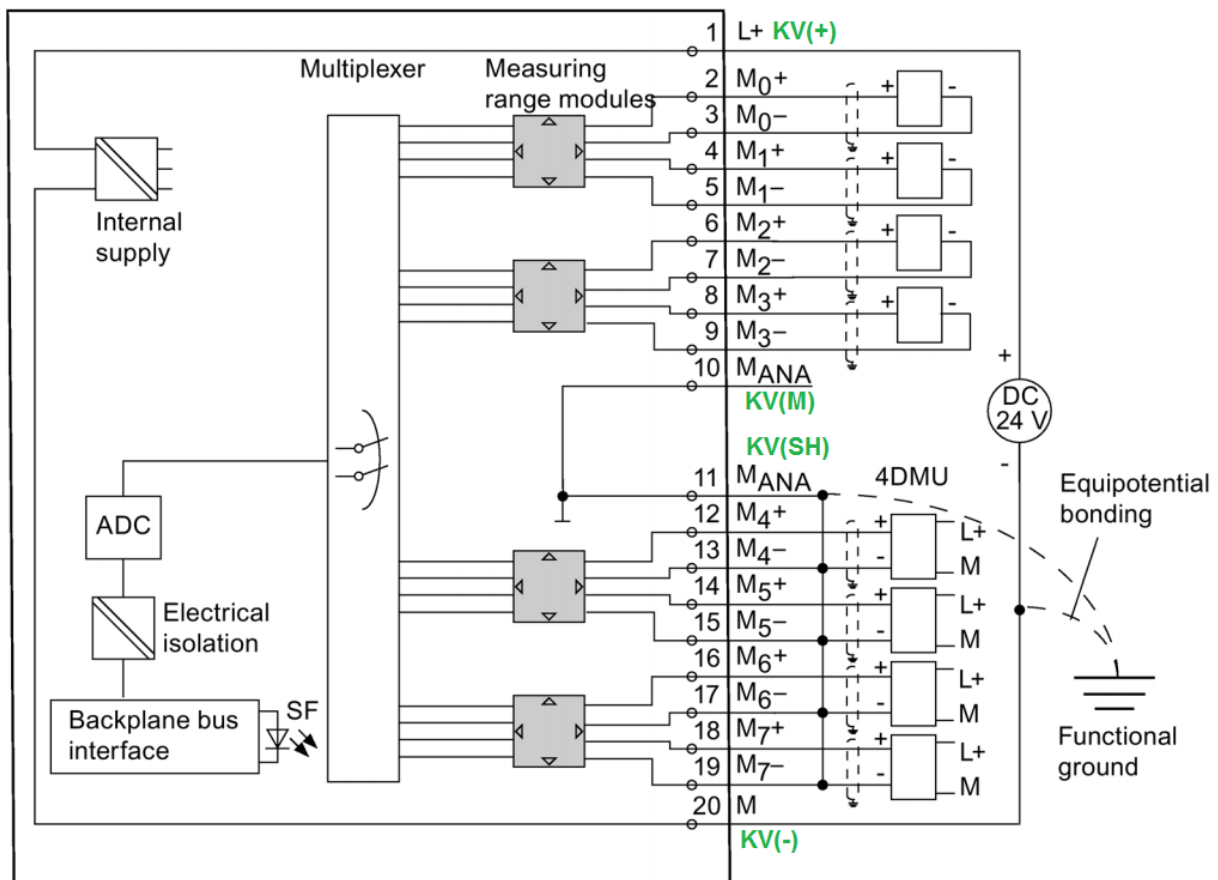
- Use the **Network- / Bus cable** function definition from the group for bus ports
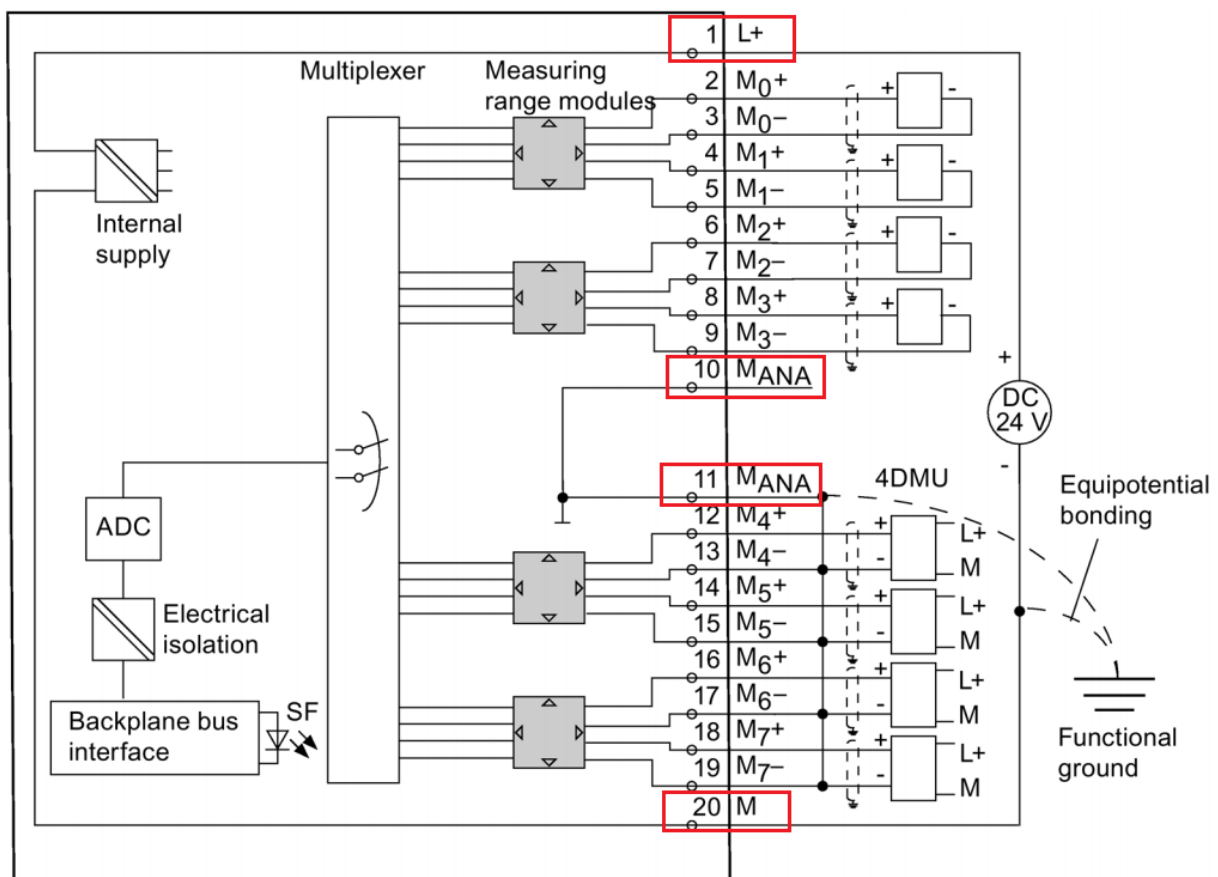
- Each function definition may only be used once since otherwise restoring of the connection point properties is not possible without errors.
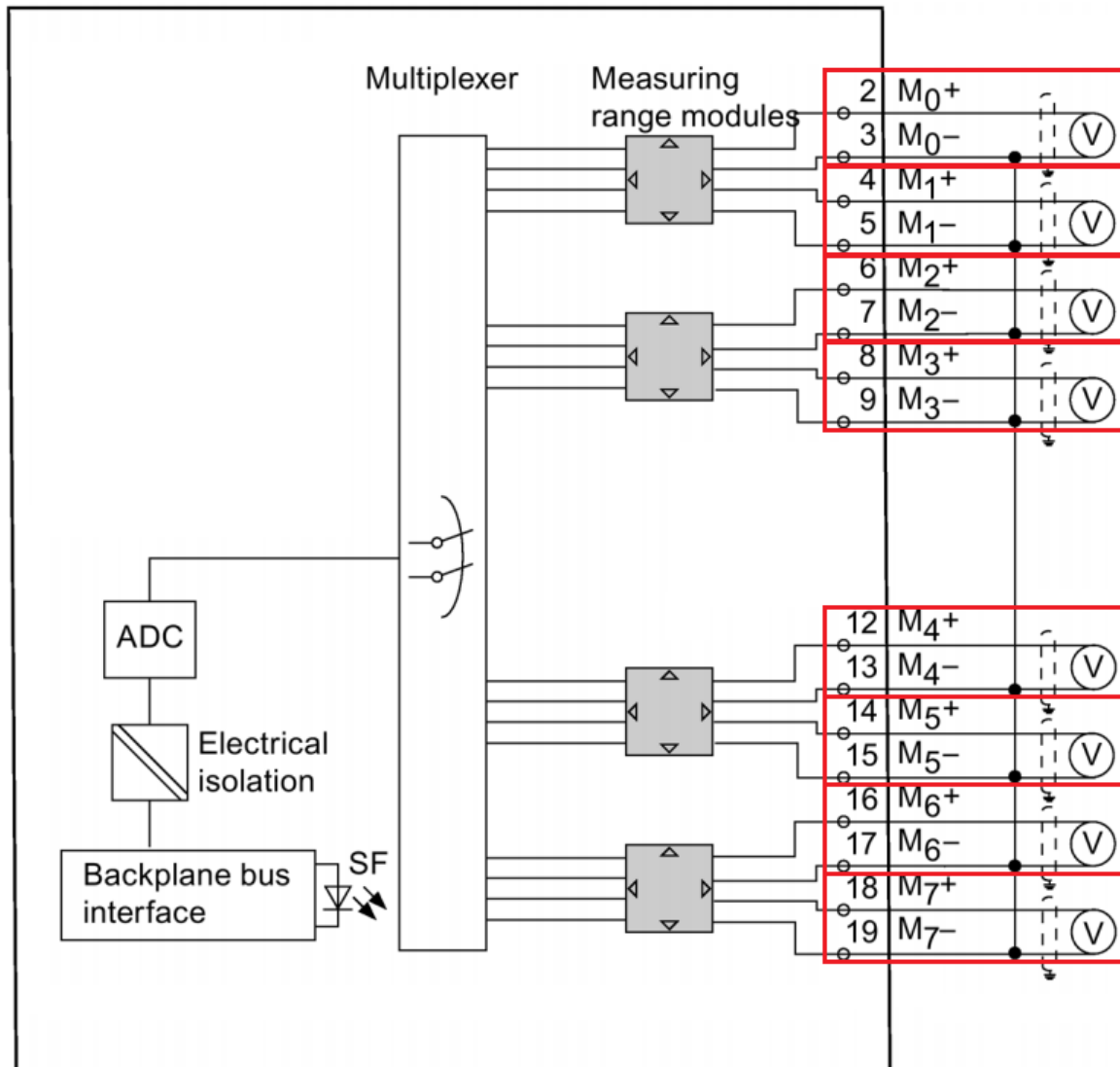
The function templates are selected according to the connection point description specified by the manufacturer:

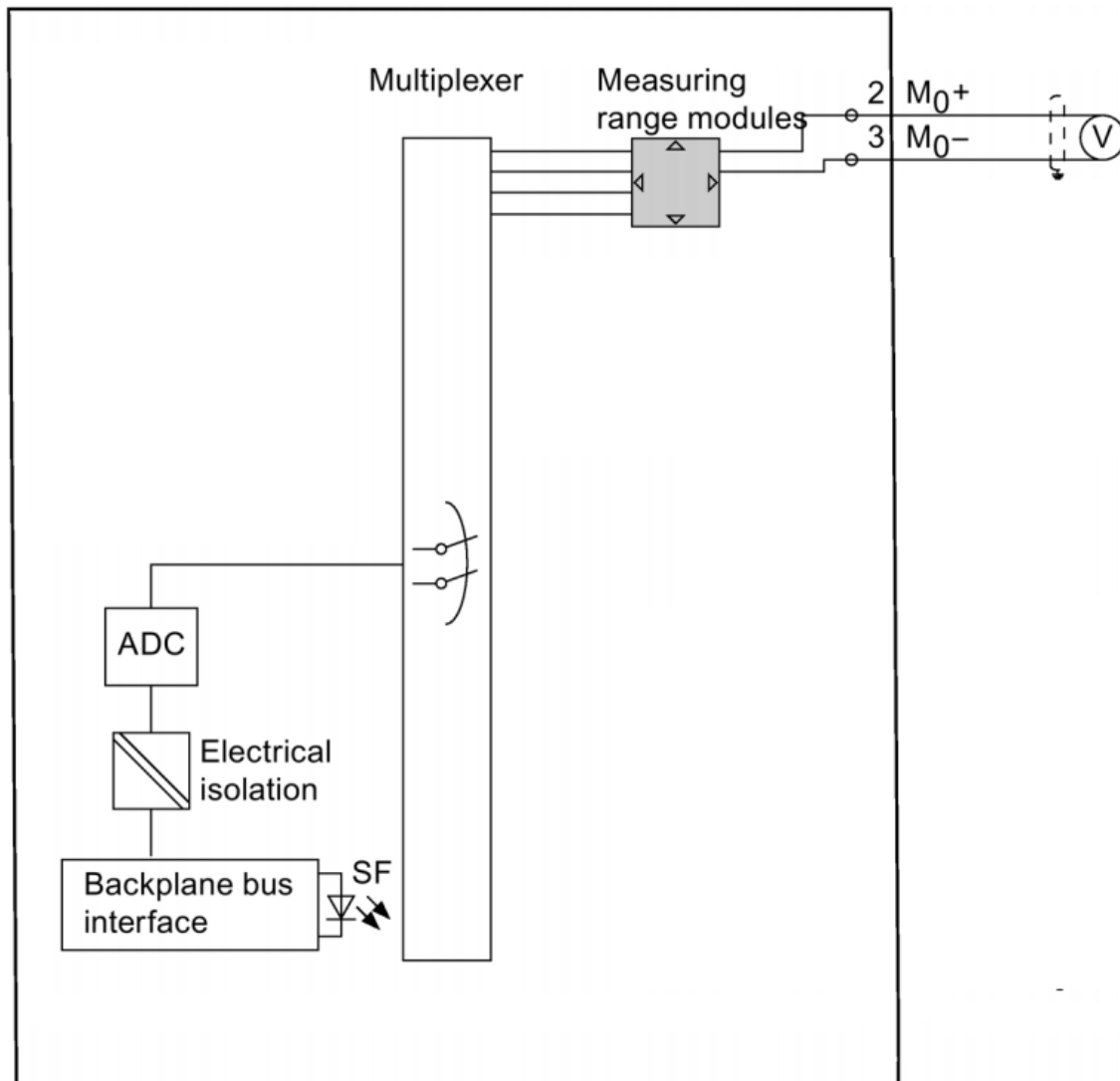|		
L+	$\rightarrow$	CS (+)
L-	$\rightarrow$	CS (-)
M_{ANA}	$\rightarrow$	CS (M)
M_{ANA}	$\rightarrow$	CS (SH)

Identifying channels

Now the channels are selected from the remaining connection points. In our example you can see eight identical channels:

Looking at a channel

Since all channels are the same, it is sufficient to look at one channel:

- Within a channel there can only be one active PLC connection point (input or output) among all connection points of a channel.

- All other connection points have to either have a function definition from the **Power supply, 1 connection point** range or must be deactivated.

> A PLC connection point is activated or deactivated with the check box **Deactivated I/O connection point**. A deactivated PLC connection point acts like a power supply.

- Each function definition from the group of power supplies may only be assigned once for one channel since otherwise it is not possible to Restore the connection point properties without errors from the overview page to the schematic page.

- For the **PLC connection point, multi-function** function definition the signal type in the logic is used to determine which actual function is used (see the section "Configurable PLC connection points" in the EPLAN Help).

- If none of the special function definitions matches at a card, you use the function definition **PLC connection point, general**.
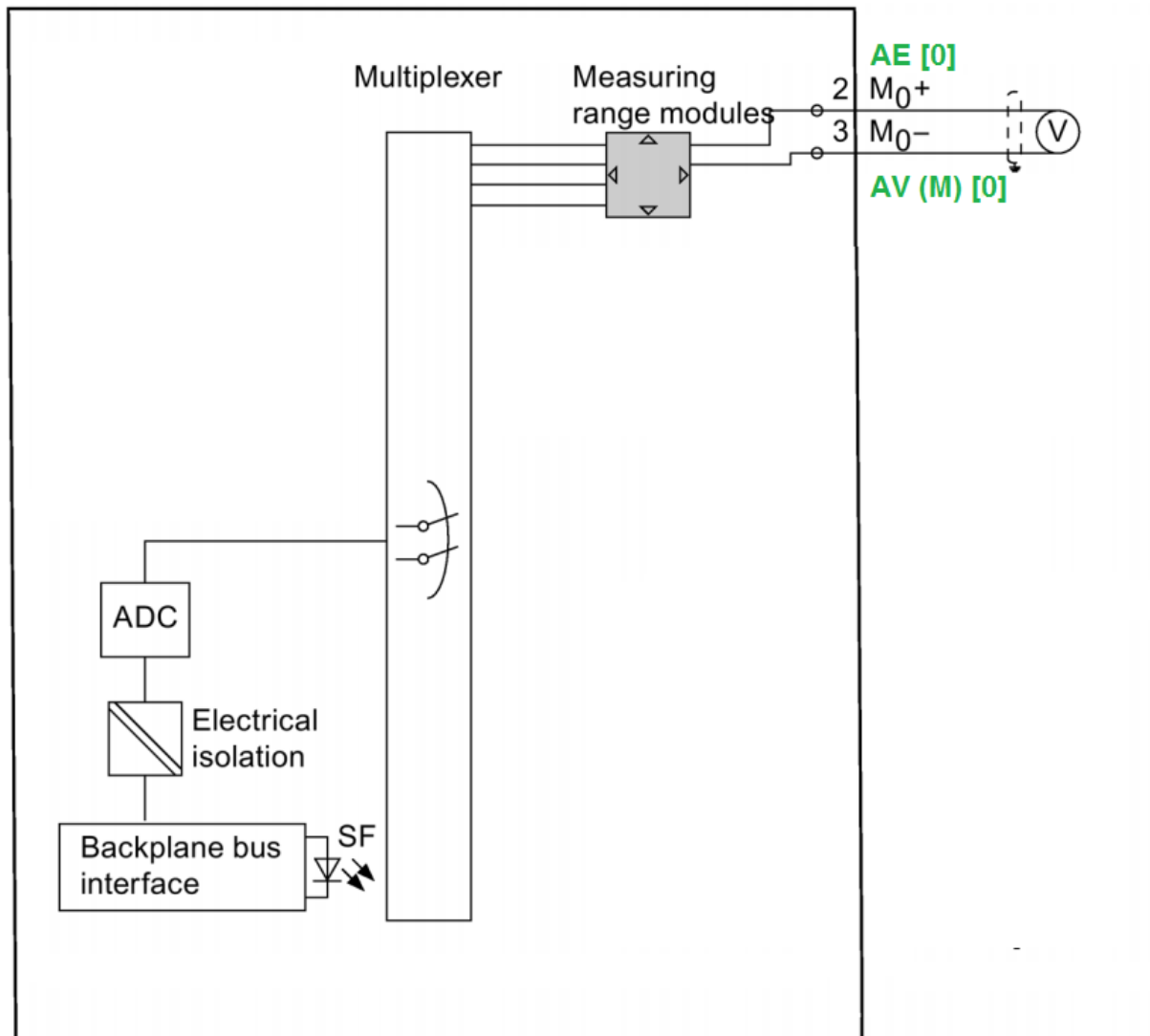
The complete card

- Now write the function definitions specified for a channel to the further channels, with a different channel designation specification.
- Ensure that you specify the channels in ascending order.
- In addition add the PLC box as function definition at the top position:

Function definition	Connection point designation	Channel designation
PLC box		
PLC connection point, PLC-CS (+)	1	
PLC connection point, AI	2	0
PLC connection point, PLC-PS (M)	3	0
PLC connection point, AI	4	1
PLC connection point, PLC-PS (M)	5	1
PLC connection point, AI	6	2
PLC connection point, PLC-PS (M)	7	2
PLC connection point, AI	8	3
PLC connection point, PLC-PS (M)	9	3
PLC connection point, PLC-CS (M)	10	
PLC connection point, PLC-CS (SH)	11	
PLC connection point, AI	12	4
PLC connection point, PLC-PS (M)	13	4
PLC connection point, AI	14	5
PLC connection point, PLC-PS (M)	15	5
PLC connection point, AI	16	6
PLC connection point, PLC-PS (M)	17	6
PLC connection point, AI	18	7
PLC connection point, PLC-PS (M)	19	7
PLC connection point, PLC-CS (-)	20	

A different view of the channels

The PLC card used in this example also allows deviating connection wirings thanks to their usage options, and thus deviating channel assignments and other function definition assignments resulting from this:
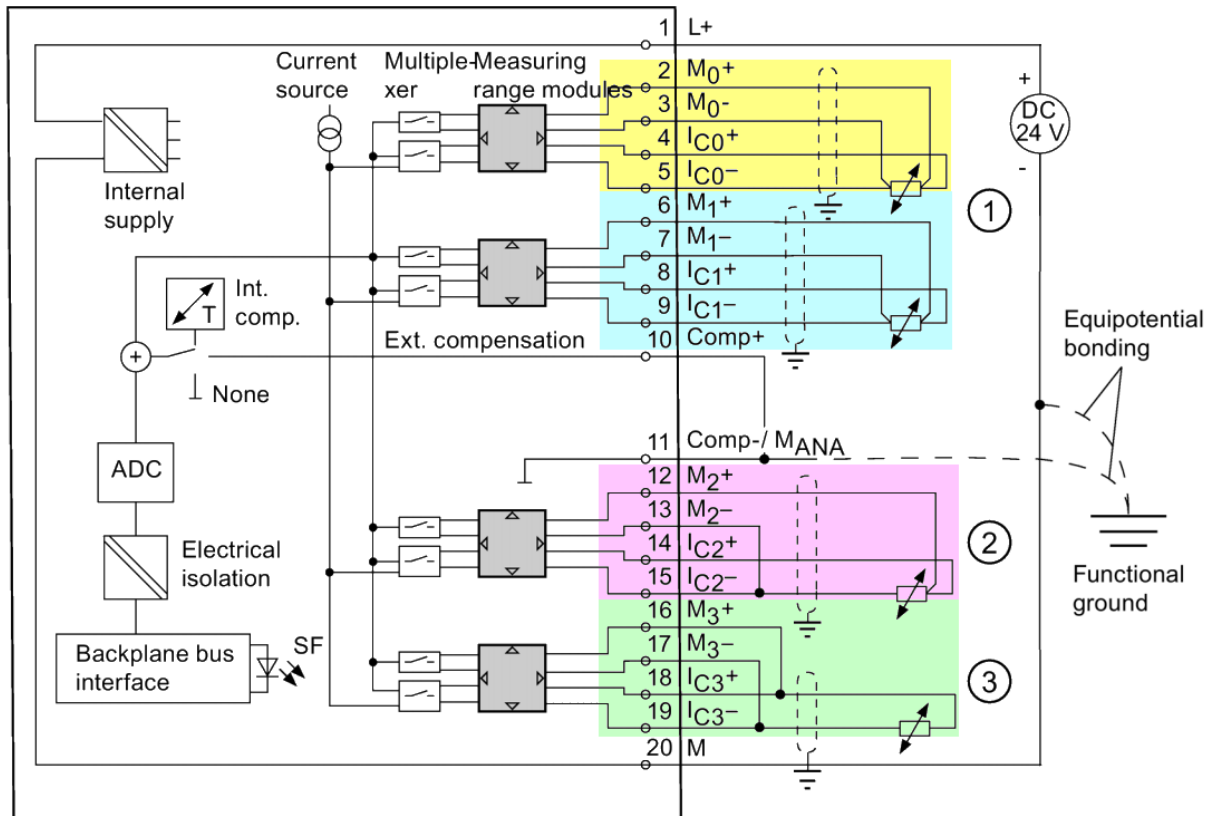
The various channels are have different background colors here and are designated as follows in the example above:

(1)   Two channels with 4-wire circuiting
(2)   One channel with 3-wire circuiting
(3)   One channels with 2-wire circuiting

In this case create a corresponding part variant in the parts management for each circuiting used.

Network / bus cable

If the module has one or more bus ports to connect extension racks or fieldbus systems, use function definitions from the**Network / bus cable** group for these bus connection points.

You can also find further information on the network connection points in the **TechTip: PLC data exchange** in the chapter "Automatic connections between network connection points that belong together".

Create a corresponding function template for each bus port (not for each pin of a bus port!). Six different function definitions are available to this purpose:

- *Source*: This is where the bus system begins.

- *Input*: The input is used to connect a device to a bus system. An additional device can be connected to the bus system via a further output. Inputs and outputs are mostly used on a card in pairs.

- *Output*: Here a bus system that was previously supplied at an input of the same device is forwarded. EPLAN assigns an output to its input.

- *End*: This is where the bus system ends. Use this function definition, for example, to identify the end of a ring bus system.

- *Switch connection point*: These connection points are used for so called "switches" and are treated like busbar connection points. This way all connection points are connected to each other.

- *General:* Is used for *Ethernet-based* bus systems or for bus ports if these are *both input and output*, for example for ASi or PROFIBUS. For Ethernet-based bus systems enter the designation of the corresponding interface into the **Bus interface: Name** property.

In the **Plug designation** field enter the designation of the corresponding pin on the device. The connection point designation remains empty in this case.

Plug designation and **Bus interface: Name** are identifying.

2.2.2. Properties in the function templates

Channel designation	20407
(Numerical) value equal to or greater than 0	
The value has to be filled and has to be in accordance with the method of counting and the number system of the PLC configuration program.	

Bus system	20308
Selection list	

Connection point designation	20038
Any string	
The connection point designation has to be unique within a PLC box.	

Connection point description	20039
Any string	
The connection point description has to be unique within a PLC box. *The connection point description may occur several times at card power supplies.*	

Plug designation	20431
Any string	
Value has to be filled at bus ports.	

PLC subdevice: Index	20384
Numerical value in the range of 0 to 12	
Specification to which subdevice this PLC connection point belongs.	

Bus interface: Name	**20447**

Any string

Serves to group bus ports for the export of Ethernet-based bus systems. Associated bus ports are combined into a logical unit via this name. These can be either bus ports of the type "Network / bus cable connection, general" or a "Network / bus cable connection, input" and a "Network / bus cable connection, output".

Value has to be filled at Ethernet-based bus ports in accordance with the hardware specifications of the PLC manufacturer.

Since Version 2.8 the plug designation is identifying together with bus interface name.

2.3. Macro creation

2.3.1. Data in the macro

In general there are two kinds of data in a macro:

- Fixed and device-dependent data

- Variable data

Fixed and device-dependent data

These data are filled with concrete values in the macro and are not changed in the project anymore.

ID	Property	Usage at		
		PLC connection point	Bus port	PLC box
20038	Connection point designation	✓	-	-
20039	Connection point description	✓	✓	-
20431	Plug designation	✓	✓	-
20428	Channel designation	✓	-	-
20405	Data type	✓	-	-
20384	PLC subdevice: Index	✓	-	-
20308	Bus system	-	✓	✓
20312	Subslot	-	✓	✓
20289	Integrated module	-	✓	✓
20409	PLC station type	-	-	✓
20416	PLC type designation	-	-	✓
20415	Device description: File name	-	-	✓
20381	Device description: Index in file	-	-	✓
20418	Version	-	-	✓
20432, 20299	Address range (SIEMENS STEP 7 Classic), Address range 2 (SIEMENS STEP 7 Classic)	-	-	✓

ID	Property	Usage at		
		PLC connection point	Bus port	PLC box
20164	**Bus coupler / head station**	-	-	✓
20189	**Bus distribution device**	-	-	✓
20184	**Power supply**	-	-	✓
20167	**CPU**	-	-	✓
20315	**PLC-specific settings**	-	-	✓
20444	**PLC card is placed on head station**	-	-	✓
20447	**Bus interface: Name**	-	✓	-
20521 ff.	**PLC subdevice x: Name**	-	-	✓
20533 ff.	**PLC subdevice x: Position (slot / module)**	-	-	✓

Variable data

After insertion of the macro in a project, these data have to be filled with values, for example by using value sets.

ID	Property	Usage at		
		PLC connection point	Bus port	PLC box
20161	**Configuration project**	-	✓	✓
20031	**Function text**	✓	✓	✓
20400	**Address**	✓	-	-
20404	**Symbolic address**	✓	-	-
20309	**DNS/PROFINET device name**	-	✓	-
20413	**Physical network: Name**	-	✓	✓
20414	**Logical network: Name**	-	✓	-
20310	**Logical network: Bus port is master**	-	✓	-
20311	**Physical network: Bus ID / position**	-	✓	✓

ID	Property	Usage at		
		PLC connection point	Bus port	PLC box
20386	**Physical network: Bus ID / position 2**	-	✓	✓
20313	**Data transfer rate**	-	✓	-
20334	**MasterSystemID**	-	✓	-
20427	**Rack**	-	-	✓
20410	**PLC card is placed on rack ID**	-	-	✓
20411	**Position (slot / module)**	-	-	✓
20258	**Sort code (for position in rack)**	-	-	✓
20448	**Bus interface: Main bus port**	-	✓	-
20419, 20255	**Start address of PLC card, Start address 2 of PLC card**	-	-	✓
20408	**PLC station ID**	-	-	✓
20437	**PLC card name**	-	-	✓
20417	**Object description**	-	-	✓
20253 [1...4]	**CPU: Name**	-	-	✓
20454, 20382, 20392 ff. 20452 ff.	**PLC subdevice x: Start address (inputs)**	-	-	✓
20455 ff., 20478 ff., 20515 ff.	**PLC subdevice x: Start address (outputs)**	-	-	✓

2.3.2.   Graphical view

- All macros for a PLC device are saved in a macro file.
  This is assigned to the corresponding part.

- The functions used for the graphical view must correspond with the function templates defined in the part.

- The PLC macros contain:
    - PLC connection points
   - PLC boxes
    - Graphic.

Multi-line

- In multi-line representations you should only work with connection point symbols - meaning without a PLC box.
  Example macro for a channel with power supplies:

```
X1  1        2        3
    IN       +        -
          -A7
          E31.2
         -Variable
          FText
```

- The correct function definition (corresponding to the part) is to be selected at each connection point.

- When using multiple symbols you have to group these so that they stay together when being moved.

- Only **one** such macro has to be available in a macro file for each channel type on a PLC card.

- A further macro is created for the card power supply.

- An 8-bit representation without PLC box can also be created with the following connection symbols:
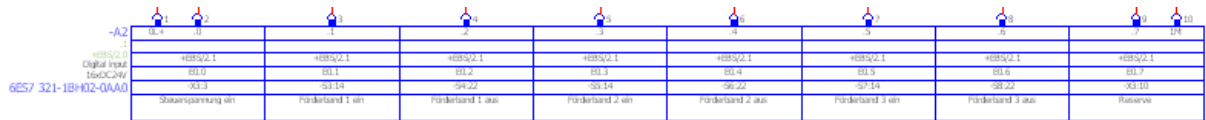
  In this case the symbols may **not** be grouped!

  The data of the main function is displayed at the first connection point, the main function itself is placed on the single-line schematic page for the rack structure.

- This allows 32 bits of a PLC card to be shown with four macros in four variants. These macros are saved in individual variants in a macro file with the "Multi-line" representation type. Four further variants are then available for the single-bit representation.

- Representation, if you do not work with connection point symbols but with a PLC box:
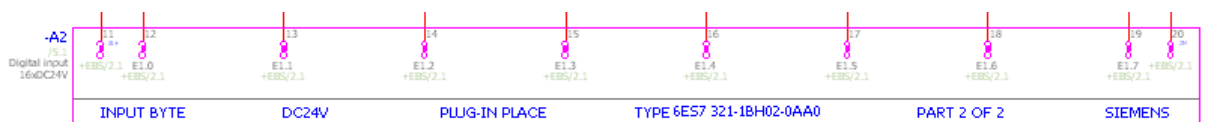
  - Use placed properties of the PLC box for the texts displayed in the lower part of the graphic.

  - The PLC box is an auxiliary function and shows the data of the main function.

  - Additional terminals and pins are not displayed.

- Bitwise representations of a PLC card in single- or multi-line representation are always saved as "Variant A" . Macros for the distributed view (one channel) are sorted after it.

Single-line (network topology)

- In single-line representations you should only work with connection point symbols - meaning without a PLC box.
 Example macro for a bus port:
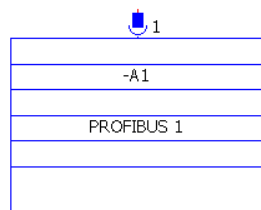
- The following property placements are to be displayed in the macro:

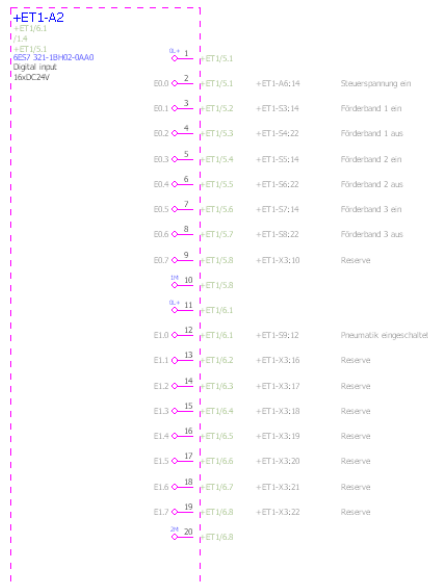| 20039	Connection point description
20006	DT
20431	Plug designation
20414	Logical network: Name
20308	Bus system
20311	Physical network: Bus ID / item number

Single-line (PLC box)

- The macro is used for the representation of the rack structure.

- The **Main function** check box is to be activated at the PLC box.

- The macro consists of a PLC box and can contain graphic elements and / or images, see example:
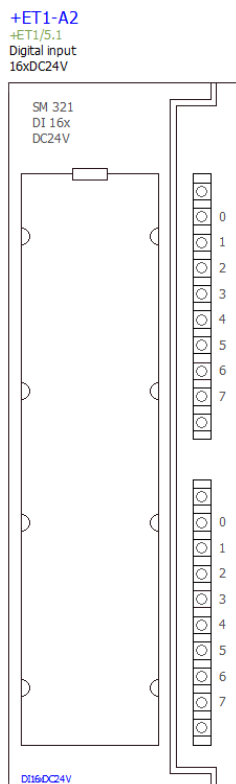
- Connection points are not represented.

Overview

- An overview macro can look as follows:

- The special symbol "40" (PLCCPOV) with the following data is used tor these connection points:

    - Property arrangement "Default value horizontal"

    - Move the "All connection point descriptions" property to the inside (X=0; Y=1,3)

- The following applies for bus ports:

    - Same DT, plug designation and function definition as in the single-line representation.

    - The following indirect properties are to be used for the properties to be displayed.

- The inside of the box can be designed freely.

- Connection points should be arranged in such a way that they correspond to the real device in order to have a recognition value.

- The overview macro is saved as "Variant A" in the "Overview" representation type.

Mounting panel (2D panel layout)

- Devices have to be drawn true to scale.

- The function definition "Part placement, PLC card" must be used.