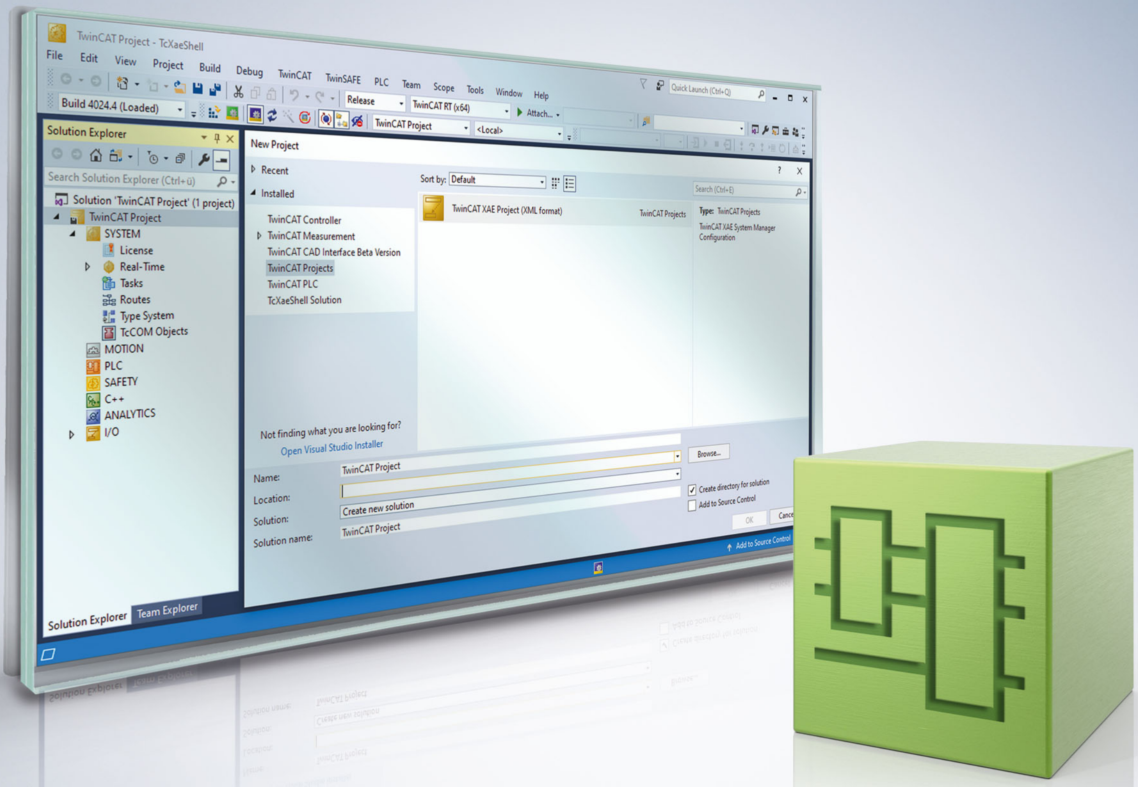
BECKHOFF New Automation Technology

Manual | EN

TE1000

TwinCAT 3 | PLC Library: Tc2_MDP



2023-10-18 | Version: 1.7.1

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1 Foreword

1.1 Notes on the documentation

This description is intended exclusively for trained specialists in control and automation technology who are familiar with the applicable national standards.
For installation and commissioning of the components, it is absolutely necessary to observe the documentation and the following notes and explanations.
The qualified personnel is obliged to always use the currently valid documentation.

The responsible staff must ensure that the application or use of the products described satisfies all requirements for safety, including all the relevant laws, regulations, guidelines, and standards.

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The documentation has been prepared with care. The products described are, however, constantly under development.
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Always observe and follow product-specific safety instructions, which you may find at the appropriate places in this document.

Exclusion of liability

All the components are supplied in particular hardware and software configurations which are appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

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This description is only intended for trained specialists in control, automation, and drive technology who are familiar with the applicable national standards.

Signal words

The signal words used in the documentation are classified below. In order to prevent injury and damage to persons and property, read and follow the safety and warning notices.

Personal injury warnings

⚠ DANGER
Hazard with high risk of death or serious injury.

⚠ WARNING
Hazard with medium risk of death or serious injury.

⚠ CAUTION
There is a low-risk hazard that could result in medium or minor injury.

Warning of damage to property or environment

NOTICE
The environment, equipment, or data may be damaged.

Information on handling the product

This information includes, for example:
recommendations for action, assistance or further information on the product.

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To stay informed about information security for Beckhoff products, subscribe to the RSS feed at https://www.beckhoff.com/secinfo.

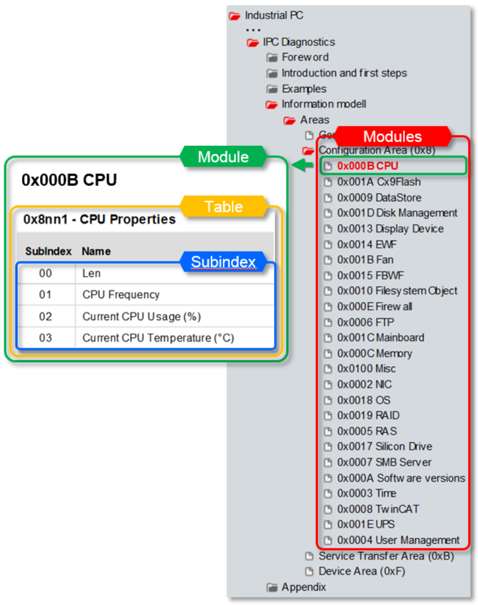
2 Introduction

Update: Tc3_IPCDiag library

The TwinCAT 3 PLC library Tc2_MDP is the predecessor to Tc3_IPCDiag. With the new Tc3_IPCDiag library the number of readable parameters has been increased and the user interface has been optimized. It is recommended to use the Tc3_IPCDiag library.
Future extensions will no longer be performed in the Tc2_MDP library. It is not recommended to use the Tc2_MDP library for new projects. All functionalities of the Tc2_MDP library can also be found in the new Tc3_IPCDiag library.

The TwinCAT 3 PLC library Tc2_MDP is used by the Beckhoff IPC diagnostics. Details can be found in the documentation: Beckhoff Device Manager.

The available IPC diagnosis data are organized in the configuration area in so-called "Modules". A module contains all the data for a particular topic. The example applies to the IPC CPU.



SubIndex	Name
00	Len
01	CPU Frequency
02	Current CPU Usage (%)
03	Current CPU Temperature (°C)

A module can in turn contain subcategories, so-called "Tables". A table organizes the detailed information that it contains in so-called "subindices". Since the contents of the list depend on the components existing in the current IPC, the list is generated dynamically – depending on what components the current PC contains, or what types of information it supports.

Example: Access to data on the mainboard requires a BIOS (and the corresponding hardware in the PC) that can supply these data.

A module therefore cannot be addressed via a fixed address. You first have to determine where exactly the module is located.

Restricted access at the time of system start

MDP forms an interface to the hardware. This is independent of TwinCAT. MDP can be accessed from TwinCAT with the PLC library. This is done internally by means of ADS communication. The versatility of the hardware configuration justifies a different initialization phase of the MDP service. It is possible that first PLC cycles are executed while the MDP initialization is not yet completed. Either the possible error outputs as well as timeouts of the function blocks from the library can be reacted and a new query can be triggered or the queries are executed deliberately delayed after the system start.
It is recommended in the PLC program not to query values from the MDP immediately after the system start, but to consider a small waiting time. How large this should be depends on various parameters (such as the performance of your control computer), and can therefore not be given as a general rule. Typically it is in the range of 10-60 seconds.

3 MDP element access options

The TwinCAT 3 PLC Tc2_MDP library offers a wide range of function blocks to facilitate comprehensive access to MDP data.

There are two basic types of function blocks in the library.
Firstly the **generic function blocks**. They can be used to query and set arbitrary parameters in the MDP themselves by means of discrete access.
Furthermore, **specific function blocks** offer the possibility of accessing certain data as well as groupings of several data with one call.

The function blocks have a uniform appearance.
All function blocks are called by a positive edge on the *bExecute* input. Afterwards, cyclic calling of the function block (*bExecute* = FALSE) returns the result of the query at the output as soon as the processing of the query has been completed (*bBusy* = FALSE). Each function block must be called (*bExecute* = FALSE) for as long as it takes for the internal processing (bBusy = FALSE) to be completed. During that time, all inputs of the function block must remain unchanged.

In general, the MDP is a model that describes hardware and software components in the form of modules. Information about these modules as well as about the device itself can be queried and changed.
A module consists of one or more tables. Each table consists of a fixed number of subindices. A subindex corresponds to a concrete element that can be accessed.
You can find more information on the setup of MDP in the MDP Information Model (Device Manager documentation). Further options for accessing the MDP are also described there.

Generic function blocks

In order to be able to query or set an IPC diagnostics parameter, the dynamic module ID of the module in which the parameter is located must be known.
This is determined with the aid of the function block FB_MDP_ScanModules [▸ 19].

Individual parameters can now be read or written by means of FB_MDP_Read [▸ 11] and FB_MDP_Write [▸ 12]. In addition to the dynamic Module ID, the number of the selected table (Table ID), the selected subindex within the table as well as further information is thereby specified for the query.

Likewise, the complete header of a module (ST_MDP_ModuleHeader [▸ 30]) can be queried with the function block FB_MDP_ReadModuleHeader [▸ 18].
The complete contents of a selected table within a module can be queried with the function block FB_MDP_ReadModuleContent [▸ 17].

The function block FB_MDP_ReadModule [▸ 15] bundles the above queries. The function block implicitly determines the dynamic Module ID and queries both header and table.
The function block FB_MDP_ReadElement [▸ 14] also determines the dynamic module ID implicitly. It can be used to query any individual IPC diagnostics parameter.
Accordingly, with these two function blocks it is not necessary to call FB_MDP_ScanModules beforehand.

Specific function blocks

The function blocks available here offer fast access to the most important IPC diagnostic information.

For example, it is sufficient to call the function block FB_MDP_NIC_Read [▸ 23] in order to query all important information about a Network Interface Card (see Device Manager documentation Module NIC). The module header is also queried and output in each case.
The specific function blocks likewise implicitly determine the dynamic Module ID, so that a prior call of FB_MDP_ScanModules [▸ 19] is superfluous.

4 Function blocks

4.1 Introduction

Update: Tc3_IPCDiag library

The TwinCAT 3 PLC library Tc2_MDP is the predecessor to Tc3_IPCDiag. With the new Tc3_IPCDiag library the number of readable parameters has been increased and the user interface has been optimized. It is recommended to use the Tc3_IPCDiag library.
Future extensions will no longer be performed in the Tc2_MDP library. It is not recommended to use the Tc2_MDP library for new projects. All functionalities of the Tc2_MDP library can also be found in the new Tc3_IPCDiag library.

Generic function blocks

A generic function block can be used to access any IPC diagnostics modules.

The application is more complex and the user requires a certain understanding of the MDP (**M**odule **D**evice **P**rofile) information model.

Sample: Accessing network card information via FB_MDP_ReadElement:

The generic function block FB_MDP_ReadElement determines the dynamic module address internally. The user only needs to specify the module instance that he wishes to access. The system has several network cards and each network card is represented by its own module instance.

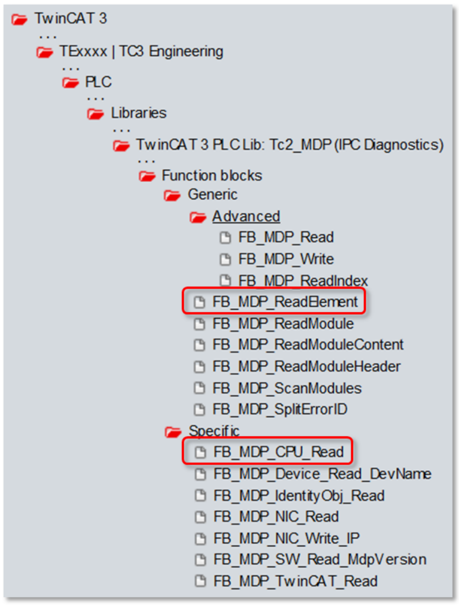
Specific function blocks

A specific function block only accesses information from a specific module. It is simple to use and requires no knowledge of the MDP information model used.

The specific function blocks available determine the dynamic module address internally.

However, specific function blocks are only available for a selection of the IPC diagnostics data.

Sample: FB_MDP_CPU_Read

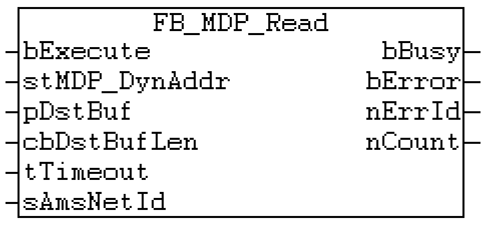


```
TwinCAT 3
 ...
  TExxxx | TC3 Engineering
   ...
    PLC
     ...
      Libraries
       ...
        TwinCAT 3 PLC Lib: Tc2_MDP (IPC Diagnostics)
         ...
          Function blocks
           Generic
            Advanced
              FB_MDP_Read
              FB_MDP_Write
              FB_MDP_ReadIndex
            FB_MDP_ReadElement
            FB_MDP_ReadModule
            FB_MDP_ReadModuleContent
            FB_MDP_ReadModuleHeader
            FB_MDP_ScanModules
            FB_MDP_SplitErrorID
           Specific
            FB_MDP_CPU_Read
            FB_MDP_Device_Read_DevName
            FB_MDP_IdentityObj_Read
            FB_MDP_NIC_Read
            FB_MDP_NIC_Write_IP
            FB_MDP_SW_Read_MdpVersion
            FB_MDP_TwinCAT_Read
```

4.2 Generic

4.2.1 Advanced

4.2.1.1 FB_MDP_Read



The function block enables querying of an IPC diagnostics module element.

VAR_INPUT

```
VAR_INPUT
    bExecute      : BOOL;             (* Function block execution is triggered by a rising edge at t
his input.*)
    stMDP_DynAddr : ST_MDP_Addr;
    pDstBuf       : DWORD;            (* Contains the address of the buffer for the received data. *
)
    cbDstBufLen   : UDINT;            (* Contains the max. number of bytes to be received. *)
    tTimeout      : TIME := DEFAULT_ADS_TIMEOUT; (* States the time before the function is cancelled
. *)
    sAmsNetId     : T_AmsNetId;       (* keep empty '' for the local device *)
END_VAR
```

bExecute: The function block is called by a rising edge on the input *bExecute*, if the block is not already active.

stMDP_DynAddr: The MDP addressing belonging to the selected network module is specified at this input. The structure is of the type ST_MDP_Addr [▶ 29]. The dynamic Module ID must already be specified with it.

pDstBuf: The memory address of the data buffer is specified at this input. The received data are stored there if the query is successful.

cbDstBufLen: The length of the data buffer in bytes is specified at this input.

tTimeout: Specifies a maximum length of time for the execution of the function block.

sAmsNetId: To execute the query on the local device, it is not necessary to specify this input variable. Alternatively, an empty string can be specified. To direct the query to another computer, its AMS Net Id (of type T_AmsNetId) can be specified here.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy   : BOOL;
    bError  : BOOL;
    nErrId  : UDINT;
    nCount  : UDINT;
END_VAR
```

bBusy: This output is TRUE as long as the function block is active.

bError: Becomes TRUE as soon as an error situation occurs.

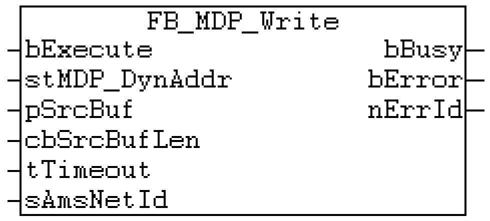
nErrID: Returns an error code [▶ 34] if the bError output is set.

nCount: This output indicates the number of bytes read.

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

4.2.1.2 FB_MDP_Write



The function block enables setting of an IPC diagnostics module element.

VAR_INPUT

```
VAR_INPUT
    bExecute       : BOOL;                (* Function block execution is triggered by a rising edge a
t this input.*)
    stMDP_DynAddr  : ST_MDP_Addr;
    pSrcBuf        : DWORD;               (* Contains the address of the buffer for the sent data. *)
    cbSrcBufLen    : UDINT;               (* Contains the max. number of bytes to be sent. *)
    tTimeout       : TIME := DEFAULT_ADS_TIMEOUT; (* States the time before the function is cancelle
d. *)
    sAmsNetId      : T_AmsNetId;          (* keep empty '' for the local device *)
END_VAR
```

bExecute: The function block is called by a rising edge on the input *bExecute*, if the block is not already active.

stMDP_DynAddr: The MDP addressing belonging to the selected network module is specified at this input. The structure is of the type ST_MDP_Addr [▶ 29]. The dynamic Module ID must already be specified with it.

pSrcBuf: The memory address of the data buffer is specified at this input. The data to be transmitted must be stored there.

cbSrcBufLen: The length of the data buffer in bytes is specified at this input.

tTimeout: Specifies a maximum length of time for the execution of the function block.

sAmsNetId: To execute the query on the local device, it is not necessary to specify this input variable. Alternatively, an empty string can be specified. To direct the query to another computer, its AMS Net Id (of type T_AmsNetId) can be specified here.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy   : BOOL;
    bError  : BOOL;
    nErrId  : UDINT;
END_VAR
```

bBusy: This output is TRUE as long as the function block is active.

bError: Becomes TRUE as soon as an error situation occurs.

nErrID: Returns an error code [▶ 34] if the bError output is set.

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

4.2.1.3 FB_MDP_ReadIndex

Update: Tc3_IPCDiag library

The TwinCAT 3 PLC library Tc2_MDP is the predecessor to Tc3_IPCDiag. With the new Tc3_IPCDiag library the number of readable parameters has been increased and the user interface has been optimized. It is recommended to use the Tc3_IPCDiag library.
Future extensions will no longer be performed in the Tc2_MDP library. It is not recommended to use the Tc2_MDP library for new projects. All functionalities of the Tc2_MDP library can also be found in the new Tc3_IPCDiag library.

The function block enables querying of any IPC diagnostics element. In addition to the Configuration Area, data from the device area are also accessible.

VAR_INPUT

```
VAR_INPUT
    bExecute    : BOOL;             (* Function block execution is triggered by a rising edge at thi
s input.*)
    nIndex      : WORD;
    nSubIndex   : BYTE;
    pDstBuf     : DWORD;            (* Contains the address of the buffer for the received data. *)
    cbDstBufLen : UDINT;            (* Contains the max. number of bytes to be received. *)
    tTimeout    : TIME := DEFAULT_ADS_TIMEOUT; (* States the time before the function is cancelled.
*)
    sAmsNetId   : T_AmsNetId;       (* keep empty '' for the local device *)
END_VAR
```

bExecute: The function block is called by a rising edge on the input *bExecute*, if the block is not already active.

nIndex: At this input the first part of the addressing for the required IPC diagnostic data is specified.

nSubIndex: At this input the second part of the addressing for the required IPC diagnostic data is specified.

pDstBuf: The memory address of the data buffer is specified at this input. The received data are stored there if the query is successful.

cbDstBufLen: The length of the data buffer in bytes is specified at this input.

tTimeout: Specifies a maximum length of time for the execution of the function block.

sAmsNetId: To execute the query on the local device, it is not necessary to specify this input variable. Alternatively, an empty string can be specified. To direct the query to another computer, its AMS Net Id (of type T_AmsNetId) can be specified here.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy  : BOOL;
    bError : BOOL;
    nErrId : UDINT;
    nCount : UDINT;
END_VAR
```

bBusy: This output is TRUE as long as the function block is active.

bError: Becomes TRUE as soon as an error situation occurs.

nErrID: Returns an error code [▶ 34] if the bError output is set.

nCount: This output indicates the number of bytes read.

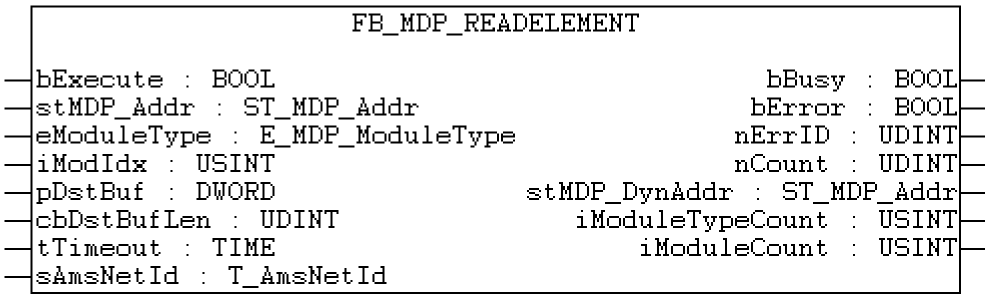
Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.4013	PC or CX (x86, x64, ARM)	Tc2_MDP

4.2.2 FB_MDP_ReadElement

Update: Tc3_IPCDiag library

The TwinCAT 3 PLC library Tc2_MDP is the predecessor to Tc3_IPCDiag. With the new Tc3_IPCDiag library the number of readable parameters has been increased and the user interface has been optimized. It is recommended to use the Tc3_IPCDiag library.
Future extensions will no longer be performed in the Tc2_MDP library. It is not recommended to use the Tc2_MDP library for new projects. All functionalities of the Tc2_MDP library can also be found in the new Tc3_IPCDiag library.



The function block enables querying of an individual MDP element. In this way, each element from each module of the Configuration Area can be read!

Internally, the device is scanned for the selected module, and the element information is queried with the dynamic module ID.

VAR_INPUT

```
VAR_INPUT
    bExecute    : BOOL;
    stMDP_Addr  : ST_MDP_Addr;        (* includes all address parameters without the Dynamic Module
Id *)
    eModuleType : E_MDP_ModuleType;   (* chosen module type out of the module type list *)
    iModIdx     : USINT;              (* chosen index(0..n) of the demanded module type. E.g. second
 NIC(idx 1) of three found NICs. *)
    pDstBuf     : DWORD;              (* Contains the address of the buffer for the received data. *
)
    cbDstBufLen : UDINT;              (* Contains the max. number of bytes to be received. *)
    tTimeout    : TIME := DEFAULT_ADS_TIMEOUT; (* States the time before the function is cancelled.
*)
    sAmsNetId   : T_AmsNetId;         (* keep empty '' for the local device *)
END_VAR
```

bExecute: The function block is called by a positive edge on the input *bExecute*, if the function block is not already active.

stMDP_Addr: At this input the MDP addressing relating to the selected MDP module is specified. The structure is of type ST_MDP_Addr [▸ 29].
The area must be specified as Configuration Area.
The dynamic module ID is only added internally and must not be specified.

iModIdx: If a MDP module is present more than once, a selection (0,...,n) can be made by means of input *iModIdx*.

pDstBuf: The memory address of the data buffer is specified at this input. The received data are stored there if the query is successful.

cbDstBufLen: An The length of the data buffer in bytes is specified at this input.

tTimeout: Specifies a maximum time duration for the execution of the function block.

sAmsNetId: To execute the query on the local device, it is not necessary to specify this input variable. Alternatively, an empty string can be specified. To direct the query to another computer, its AMS Net Id (of type T_AmsNetId) can be specified here.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy             : BOOL;
    bError            : BOOL;         (* indicates if Read was successfull or not *)
    nErrID            : UDINT;
    nCount            : UDINT;
    stMDP_DynAddr     : ST_MDP_Addr;  (* includes the new dynamic module type id. *)
    iModuleTypeCount  : USINT;        (* returns the number of found modules equal the demanded modul
e type. *)
    iModuleCount      : USINT;        (* returns the number of all detected MDP modules. *)
END_VAR
```

bBusy: This output is TRUE as long as the function block is active.

bError: Becomes TRUE as soon as an error situation occurs.

nErrID: Returns an error code [▸ 34] if the bError output is set.

nCount: This output indicates the number of bytes read.

stMDP_DynAddr: At this output the MDP addressing relating to the selected MDP module is specified. The structure is of the type ST_MDP_Addr [▸ 29]. The dynamic Module ID was added by the function block.

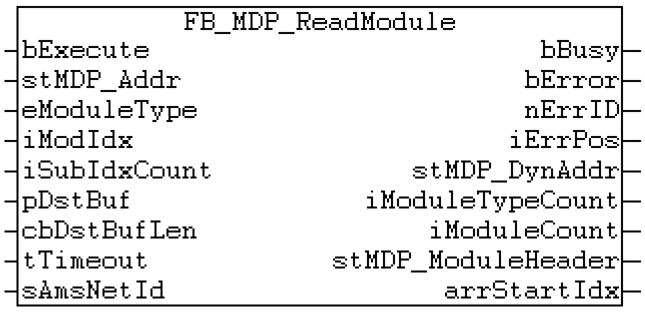
iModuleTypeCount: The output *iModuleTypeCount* indicates the number of modules that correspond to the specified type.

iModuleCount: The output *iModuleCount* indicates the entire number of modules on the device.

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

4.2.3 FB_MDP_ReadModule



The function block enables an MDP module to be queried.

The device is scanned internally for the selected module and the module header and the module information are queried with the dynamic Module ID.

VAR_INPUT

```
VAR_INPUT
    bExecute     : BOOL;
    stMDP_Addr   : ST_MDP_Addr;          (* includes all address parameters without the Dynamic Module
 Id *)
    eModuleType  : E_MDP_ModuleType;     (* chosen module type out of the module type list *)
    iModIdx      : USINT;                (* chosen index(0..n) of the demanded module type. E.g. secon
d NIC(idx 1) of three found NICs. *)
    iSubIdxCount : USINT;
    pDstBuf      : DWORD;                (* Contains the address of the buffer for the received data.
*)
    cbDstBufLen  : UDINT;                (* Contains the max. number of bytes to be received. *)
    tTimeout     : TIME := DEFAULT_ADS_TIMEOUT; (* States the time before the function is cancelled.
 *)
    sAmsNetId    : T_AmsNetId;           (* keep empty '' for the local device *)
END_VAR
```

bExecute: The function block is called by a rising edge on the input *bExecute*, if the block is not already active.

stMDP_Addr: The MDP addressing belonging to the selected module is specified at this input. The structure is of the type ST_MDP_Addr [▶ 29]. The dynamic Module ID is only added internally.

eModuleType: The MDP module type is specified at this input. The possible types are listed in the enumeration E_MDP_ModuleType [▶ 29]. (General information: module types list)

iModIdx: If several instances of an MDP module exist, a selection can be made by means of the input *iModIdx* (0,...,n).

iSubIdxCount: The input *iSubIdxCount* is used to specify how many subindices of the selected Table ID are to be queried.

pDstBuf: The memory address of the data buffer is specified at this input. The received data are stored there if the query is successful.

cbDstBufLen: The length of the data buffer in bytes is specified at this input.

tTimeout: Specifies a maximum length of time for the execution of the function block.

sAmsNetId: To execute the query on the local device, it is not necessary to specify this input variable. Alternatively, an empty string can be specified. To direct the query to another computer, its AMS Net Id (of type T_AmsNetId) can be specified here.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy        : BOOL;
    bError       : BOOL;                (* indicates if Read was successfull or not *)
    nErrID       : UDINT;
    iErrPos      : USINT;
    stMDP_DynAddr      : ST_MDP_Addr;   (* includes the new dynamic module type id. *)
    iModuleTypeCount   : USINT;         (* returns the number of found modules equal the demanded mo
dule type. *)
    iModuleCount       : USINT;         (* returns the number of all detected MDP modules. *)
    stMDP_ModuleHeader : ST_MDP_ModuleHeader;
    arrStartIdx        : ARRAY[0..255] OF UINT; (* startindexes in bytes of each subindex element *)
END_VAR
```

bBusy: This output is TRUE as long as the function block is active.

bError: Becomes TRUE as soon as an error situation occurs.

nErrID: Returns an error code [▶ 34] if the bError output is set.

iErrPos: If an error occurred and this refers to an individual element, then this output indicates the position (subindex of the element) at which an error first occurred.

stMDP_DynAddr: At this output the MDP addressing relating to the selected MDP module is specified. The structure is of the type ST_MDP_Addr [▶ 29]. The dynamic Module ID was added by the function block.

iModuleTypeCount: The output *iModuleTypeCount* indicates the number of modules that correspond to the specified type.

iModuleCount: The output *iModuleCount* indicates the entire number of modules on the device.

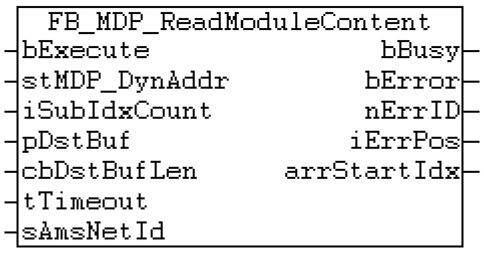
stMDP_ModuleHeader: The header information from the read MDP module is displayed at this output in the form of the structure ST_MDP_ModuleHeader. [▶ 30]

arrStartIdx: This array describes how the individually queried subindices have been stored in the buffer. The array index zero indicates the position in bytes at which the data of subindex zero begins in the buffer. Subsequent subindices are handled analogously.

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

4.2.4 FB_MDP_ReadModuleContent



The function block enables querying of the content of an IPC diagnostics module.

VAR_INPUT

```
VAR_INPUT
    bExecute       : BOOL;
    stMDP_DynAddr  : ST_MDP_Addr;     (* includes the dynamic module type for which the module content
 is requested. All subindexes of the chosen table are requested. *)
    iSubIdxCount   : USINT;           (* the number of SubIndexes to be requested *)
    pDstBuf        : DWORD;           (* Contains the address of the buffer for the received data. *)
    cbDstBufLen    : UDINT;           (* Contains the max. number of bytes to be received. *)
    tTimeout       : TIME := DEFAULT_ADS_TIMEOUT; (* States the time before the function is cancelled
. *)
    sAmsNetId      : T_AmsNetId;      (* keep empty '' for the local device *)
END_VAR
```

bExecute: The function block is called by a rising edge on the input *bExecute*, if the block is not already active.

stMDP_DynAddr: The MDP addressing belonging to the selected module is specified at this input. The structure is of the type ST_MDP_Addr [▶ 29]. The dynamic Module ID must already be transferred with it.

iSubIdxCount: The input *iSubIdxCount* is used to specify how many subindices of the selected Table ID are to be queried.

pDstBuf: The memory address of the data buffer is specified at this input. The received data are stored there if the query is successful.

cbDstBufLen: The length of the data buffer in bytes is specified at this input.

tTimeout: Specifies a maximum length of time for the execution of the function block.

sAmsNetId: To execute the query on the local device, it is not necessary to specify this input variable. Alternatively, an empty string can be specified. To direct the query to another computer, its AMS Net Id (of type T_AmsNetId) can be specified here.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy       : BOOL;
    bError      : BOOL;      (* indicates if Read was successfull or not *)
    nErrID      : UDINT;
    iErrPos     : USINT;
    arrStartIdx : ARRAY[0..255] OF UINT;     (* startindexes in bytes of each subindex element *)
END_VAR
```

bBusy: This output is TRUE as long as the function block is active.

bError: Becomes TRUE as soon as an error situation occurs.

nErrID: Returns an error code [▶ 34] if the bError output is set.

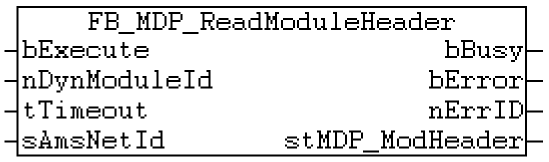
iErrPos: If an error occurred and this refers to an individual element, then this output indicates the position (subindex of the element) at which an error first occurred.

arrStartIdx: This array describes how the individually queried subindices have been stored in the buffer. The array index zero indicates the position in bytes at which the data of subindex zero begins in the buffer. Subsequent subindices are handled analogously.

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

4.2.5 FB_MDP_ReadModuleHeader



The function block enables querying of the header of an IPC diagnostics module.

VAR_INPUT

```
VAR_INPUT
    bExecute     : BOOL;
    nDynModuleId : BYTE;             (* the dynamic module id for which the module header is request
ed *)
    tTimeout     : TIME := DEFAULT_ADS_TIMEOUT; (* States the time before the function is cancelled.
 *)
    sAmsNetId    : T_AmsNetId;       (* keep empty '' for the local device *)
END_VAR
```

bExecute: The function block is called by a rising edge on the input *bExecute*, if the block is not already active.

stMDP_DynAddr: The MDP addressing belonging to the selected network module is specified at this input. The dynamic Module ID must already be specified with it.

tTimeout: Specifies a maximum length of time for the execution of the function block.

sAmsNetId: To execute the query on the local device, it is not necessary to specify this input variable. Alternatively, an empty string can be specified. To direct the query to another computer, its AMS Net Id (of type T_AmsNetId) can be specified here.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy           : BOOL;
    bError          : BOOL;    (* indicates if Read was successfull or not *)
    nErrID          : UDINT;
    stMDP_ModHeader : ST_MDP_ModuleHeader;
END_VAR
```

bBusy: This output is TRUE as long as the function block is active.

bError: Becomes TRUE as soon as an error situation occurs.

nErrID: Returns an error code [▸ 34] if the bError output is set.

stMDP_ModuleHeader: At this output the header information for the read IPC diagnostics modules is displayed in the form of the structure ST_MDP_ModuleHeader [▸ 30].

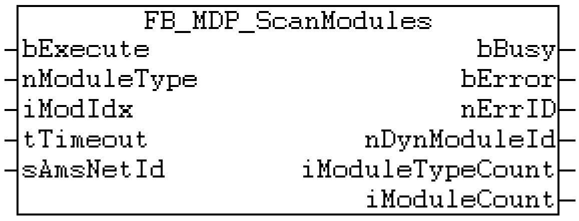
Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

4.2.6 FB_MDP_ScanModules

Update: Tc3_IPCDiag library

The TwinCAT 3 PLC library Tc2_MDP is the predecessor to Tc3_IPCDiag. With the new Tc3_IPCDiag library the number of readable parameters has been increased and the user interface has been optimized. It is recommended to use the Tc3_IPCDiag library.
Future extensions will no longer be performed in the Tc2_MDP library. It is not recommended to use the Tc2_MDP library for new projects. All functionalities of the Tc2_MDP library can also be found in the new Tc3_IPCDiag library.



The function block enables a device to be searched for a specific IPC diagnostics module.
A selection can be made if the module type is present more than once. For the selected module type the dynamic module ID is determined by the function block.
This is an important part of the MDP addressing, which is represented in the structure ST_MDP_Addr [▸ 29].

VAR_INPUT

```
VAR_INPUT
    bExecute    : BOOL;
    nModuleType : WORD;             (* chosen module type out of the module type list *)
    iModIdx     : USINT;            (* chosen index(0..n) of the demanded module type. E.g. second N
IC(idx 1) of three found NICs. *)
    tTimeout    : TIME := DEFAULT_ADS_TIMEOUT; (* States the time before the function is cancelled.
*)
    sAmsNetId   : T_AmsNetId;       (* keep empty '' for the local device *)
END_VAR
```

bExecute: The function block is called by a rising edge on the input *bExecute*, if the block is not already active.

nModuleType: At this input is the IPC diagnostics module type is specified. The possible types are listed in the enumeration E_MDP_ModuleType [▸ 29]. (general information on IPC diagnostics module types.)

iModIdx: If several instances of an IPC diagnostics module exist, a selection can be made by means of the input *iModIdx* (0,...,n).
In the case of uncertainty concerning the selection: information about which module is explicitly concerned can be queried via the function block FB_MDP_ReadModuleHeader [▸ 18] after scanning.

tTimeout: Specifies a maximum length of time for the execution of the function block.

sAmsNetId: To execute the query on the local device, it is not necessary to specify this input variable. Alternatively, an empty string can be specified. To direct the query to another computer, its AMS Net Id (of type T_AmsNetId) can be specified here.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy     : BOOL;
    bError    : BOOL;      (* indicates if Scan was successfull or not *)
    nErrID    : UDINT;
    nDynModuleId      : BYTE;   (* Dynamic Module Id *)
    iModuleTypeCount : USINT;  (* returns the number of found modules equal the demanded module type.
 *)
    iModuleCount      : USINT;  (* returns the number of all detected MDP modules. *)
END_VAR
```

bBusy: This output is TRUE as long as the function block is active.

bError: Becomes TRUE as soon as an error situation occurs.

nErrID: Returns an error code [▶ 34] if the bError output is set.

nDynModuleId: This output indicates the dynamic Module ID determined for the selected module.

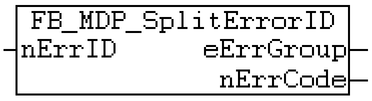
iModuleTypeCount: The output *iModuleTypeCount* indicates the number of modules that correspond to the specified type.

iModuleCount: The output *iModuleCount* indicates the entire number of modules on the device.

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

4.2.7 FB_MDP_SplitErrorId



The function block enables the *nErrID* to be split into an error group [▶ 34] and a specific error code.

Accordingly, this function block can be referred to for the simplified evaluation of *nErrID*.

VAR_INPUT

```
VAR_INPUT
    nErrID : UDINT;
END_VAR
```

nErrID: nErrID is specified as an input on the function block. This 4-byte variable corresponds to the output nErrID on an MDP function block.

VAR_OUTPUT

```
VAR_OUTPUT
    eErrGroup : E_MDP_ErrGroup;  (* type of transmitted error code *)
    nErrCode  : UINT;            (* error code [see specific error type table] *)
END_VAR
```

eErrGroup: The output eErrGroup corresponds to a value of the enumeration E_MDP_ErrGroup [▶ 34]. It is possible with the aid of the error group to distinguish the type of error or the source of error concerned.

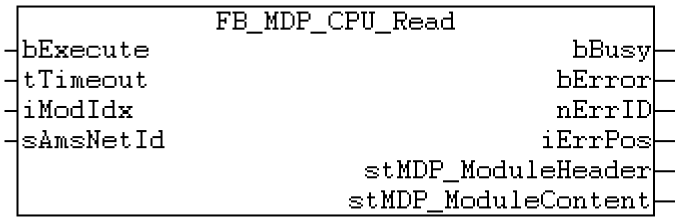
nErrCode: The error code is specific for each error group.

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

4.3 Specific

4.3.1 FB_MDP_CPU_Read



The function block enables querying of the IPC diagnostics module CPU.

VAR_INPUT

```
VAR_INPUT
    bExecute   : BOOL;          (* Function block execution is triggered by a rising edge at this inpu
t.*)
    tTimeout   : TIME := DEFAULT_ADS_TIMEOUT; (* States the time before the function is cancelled. *)
    iModIdx    : USINT := 0;    (* Index number of chosen MDP module *)
    sAmsNetId  : T_AmsNetId;    (* keep empty '' for the local device *)
END_VAR
```

bExecute: The function block is called by a rising edge on the input *bExecute*, if the block is not already active.

tTimeout: Specifies a maximum length of time for the execution of the function block.

iModIdx: If several instances of an IPC diagnostics module exist, a selection can be made by means of the input iModIdx (0,...,n).

sAmsNetId: To execute the query on the local device, it is not necessary to specify this input variable. Alternatively, an empty string can be specified. To direct the query to another computer, its AMS Net Id (of type T_AmsNetId) can be specified here.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy      : BOOL;
    bError     : BOOL;
    nErrID     : UDINT;
    iErrPos    : USINT;
    stMDP_ModuleHeader  : ST_MDP_ModuleHeader;
    stMDP_ModuleContent : ST_MDP_CPU;
END_VAR
```

bBusy: This output is TRUE as long as the function block is active.

bError: Becomes TRUE as soon as an error situation occurs.

nErrID: Returns an error code [▶ 34] if the bError output is set.

iErrPos: If an error occurred and this refers to an individual element, then this output indicates the position (subindex of the element) at which an error first occurred.

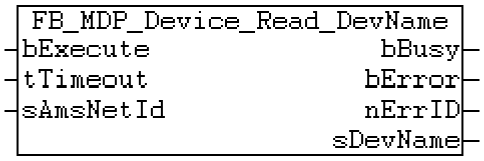
stMDP_ModuleHeader: At this output the header information for the read IPC diagnostics modules is displayed in the form of the structure ST_MDP_ModuleHeader [▶ 30].

stMDP_ModuleContent: The information from TableID 1 of the read IPC diagnostics module is displayed at this output in the form of the structure ST_MDP_CPU [▶ 30].

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

4.3.2 FB_MDP_Device_Read_DevName



The function block enables the device name to be queried. This information can be found in the general area of the IPC diagnostics.

VAR_INPUT

```
VAR_INPUT
    bExecute   : BOOL;            (* Function block execution is triggered by a rising edge at this in
put.*)
```

```
    tTimeout   : TIME := DEFAULT_ADS_TIMEOUT; (* States the time before the function is cancelled. *)
    sAmsNetId : T_AmsNetId;      (* keep empty '' for the local device *)
END_VAR
```

bExecute: The function block is called by a rising edge on the input *bExecute*, if the block is not already active.

tTimeout: Specifies a maximum length of time for the execution of the function block.

sAmsNetId: To execute the query on the local device, it is not necessary to specify this input variable. Alternatively, an empty string can be specified. To direct the query to another computer, its AMS Net Id (of type T_AmsNetId) can be specified here.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy     : BOOL;
    bError    : BOOL;
    nErrID    : UDINT;
    sDevName : T_MaxString;
END_VAR
```

bBusy: This output is TRUE as long as the function block is active.

bError: Becomes TRUE as soon as an error situation occurs.

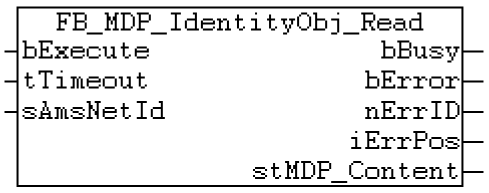
nErrID: Returns an error code [▶ 34] if the bError output is set.

sDevName: The queried name is output as a string at this output.

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

4.3.3 FB_MDP_IdentityObj_Read



Der Funktionsbaustein ermöglicht die Abfrage der Tabelle IdentityObject der General Area der IPC-Diagnose.

VAR_INPUT

```
VAR_INPUT
    bExecute   : BOOL; (* Function block execution is triggered by a rising edge at this input.*)
    tTimeout   : TIME := DEFAULT_ADS_TIMEOUT; (* States the time before the function is cancelled. *)
    sAmsNetId : T_AmsNetId; (* keep empty '' for the local device *)
END_VAR
```

bExecute: The function block is called by a rising edge on the input *bExecute*, if the block is not already active.

tTimeout: Specifies a maximum length of time for the execution of the function block.

sAmsNetId: To execute the query on the local device, it is not necessary to specify this input variable. Alternatively, an empty string can be specified. To direct the query to another computer, its AMS Net Id (of type T_AmsNetId) can be specified here.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy    : BOOL;
    bError   : BOOL;
    nErrID  : UDINT;
    iErrPos : USINT;
    stMDP_ModuleContent : ST_MDP_IdentityObject;
END_VAR
```

bBusy: This output is TRUE as long as the function block is active.

bError: Becomes TRUE as soon as an error situation occurs.

nErrID: Returns an error code [▸ 34] if the bError output is set.

iErrPos: If an error occurred and this refers to an individual element, then this output indicates the position (subindex of the element) at which an error first occurred.

stMDP_ModuleContent: The information from the table is displayed at this output in the form of the structure ST_MDP_IdentityObject [▸ 30].

Serial number is no longer supported

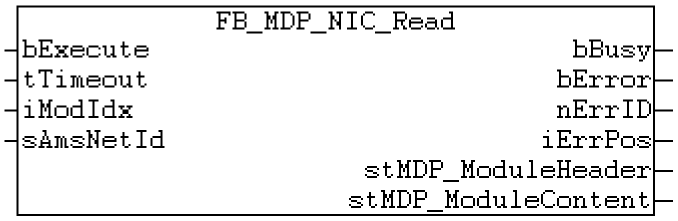
Outdated parameter leads to error situation

In the Identity Object the serial number of the IPC is read from the MDP General Area. This parameter is obsolete. The parameter is no longer supported for newer Beckhoff IPC devices. This causes the function block to return an error and name the error position (`iErrPos = 4`), which corresponds to the `iSerialNumber` parameter.
Alternatively, the serial number can be read from the MDP Device Area. See corresponding example [▸ 52].
It is recommended to use the PLC library Tc3_IPCDiag, which is the successor to the PLC library Tc2_MDP.

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

4.3.4 FB_MDP_NIC_Read



The function block enables querying of the IPC diagnostics Moduls NIC (Network Interface Card).

VAR_INPUT

```
VAR_INPUT
    bExecute  : BOOL;           (* Function block execution is triggered by a rising edge at this in
put.*)
    tTimeout  : TIME := DEFAULT_ADS_TIMEOUT; (* States the time before the function is cancelled. *)
    iModIdx   : USINT := 0;     (* Index number of chosen MDP module *)
    sAmsNetId : T_AmsNetId;     (* keep empty '' for the local device *)
END_VAR
```

bExecute: The function block is called by a rising edge on the input *bExecute*, if the block is not already active.

tTimeout: Specifies a maximum length of time for the execution of the function block.

iModIdx: If several instances of an IPC diagnostics module exist, a selection can be made by means of the input iModIdx (0,...,n).

sAmsNetId: To execute the query on the local device, it is not necessary to specify this input variable. Alternatively, an empty string can be specified. To direct the query to another computer, its AMS Net Id (of type T_AmsNetId) can be specified here.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy       : BOOL;
    bError      : BOOL;
    nErrID      : UDINT;
    iErrPos     : USINT;
    stMDP_ModuleHeader   : ST_MDP_ModuleHeader;
    stMDP_ModuleContent  : ST_MDP_NIC_Properties;
END_VAR
```

bBusy: This output is TRUE as long as the function block is active.

bError: Becomes TRUE as soon as an error situation occurs.

nErrID: Returns an error code [▶ 34] if the bError output is set.

iErrPos: If an error occurred and this refers to an individual element, then this output indicates the position (subindex of the element) at which an error first occurred.

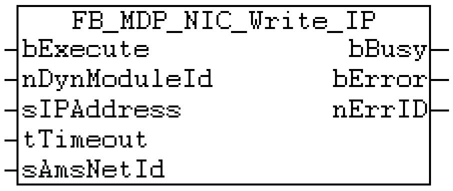
stMDP_ModuleHeader: At this output the header information for the read IPC diagnostics modules is displayed in the form of the structure ST_MDP_ModuleHeader [▶ 30].

stMDP_ModuleContent: The information from TableID 1 of the read IPC diagnostics module is displayed at this output in the form of the structure ST_MDP_NIC [▶ 31].

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

4.3.5 FB_MDP_NIC_Write_IP



The function block enables a new IP address to be set. This element is part of the IPC diagnostics Moduls NIC.

Please note that changes of this kind affect an existing network connection to the computer.

VAR_INPUT

```
VAR_INPUT
    bExecute      : BOOL;
    nDynModuleId : BYTE;              (* the dynamic module id *)
    sIPAddress    : T_MaxString;      (* IP Address *)
    tTimeout      : TIME := DEFAULT_ADS_TIMEOUT; (* States the time before the function is cancelled.
 *)
    sAmsNetId     : T_AmsNetId;       (* keep empty '' for the local device *)
END_VAR
```

bExecute: The function block is called by a rising edge on the input *bExecute*, if the block is not already active.

nDynModuleId: The dynamic Module ID belonging to the selected network module is specified at this input.

sIPAddress: The IP address specified at this input in the form of a string is transmitted.

tTimeout: Specifies a maximum length of time for the execution of the function block.

sAmsNetId: To execute the query on the local device, it is not necessary to specify this input variable. Alternatively, an empty string can be specified. To direct the query to another computer, its AMS Net Id (of type T_AmsNetId) can be specified here.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy  : BOOL;
    bError : BOOL;
    nErrID : UDINT;
END_VAR
```

bBusy: This output is TRUE as long as the function block is active.

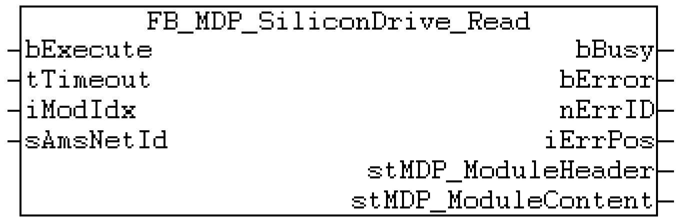
bError: Becomes TRUE as soon as an error situation occurs.

nErrID: Returns an error code [▶ 34] if the bError output is set.

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

4.3.6 FB_MDP_SiliconDrive_Read



The function block enables querying of the IPC diagnostics module SiliconDrive.

Obsolete functionality

The SiliconDrive hardware was replaced by newer memory card types. The functionality is therefore obsolete. We recommend using the query of the IPC diagnostic module Physical Drive SMARTParameters instead.

VAR_INPUT

```
VAR_INPUT
    bExecute  : BOOL;         (* Function block execution is triggered by a rising edge at this inpu
t.*)
    tTimeout  : TIME := DEFAULT_ADS_TIMEOUT; (* States the time before the function is cancelled. *)
    iModIdx   : USINT := 0;     (* Index number of chosen MDP module *)
    sAmsNetId : T_AmsNetId;     (* keep empty '' for the local device *)
END_VAR
```

bExecute: The function block is called by a rising edge on the input *bExecute*, if the block is not already active.

tTimeout: Specifies a maximum length of time for the execution of the function block.

iModIdx: If several instances of an IPC diagnostics module exist, a selection can be made by means of the input iModIdx (0,...,n).

sAmsNetId: To execute the query on the local device, it is not necessary to specify this input variable. Alternatively, an empty string can be specified. To direct the query to another computer, its AMS Net Id (of type T_AmsNetId) can be specified here.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy    : BOOL;
    bError   : BOOL;
    nErrID   : UDINT;
    iErrPos : USINT;
    stMDP_ModuleHeader   : ST_MDP_ModuleHeader;
    stMDP_ModuleContent : ST_MDP_SiliconDrive;
END_VAR
```

bBusy: This output is TRUE as long as the function block is active.

bError: Becomes TRUE as soon as an error situation occurs.

nErrID: Returns an error code [▶ 34] if the bError output is set.

iErrPos: If an error occurred and this refers to an individual element, then this output indicates the position (subindex of the element) at which an error first occurred.

stMDP_ModuleHeader: At this output the header information for the read IPC diagnostics modules is displayed in the form of the structure ST_MDP_ModuleHeader [▶ 30].

stMDP_ModuleContent: The information from TableID 1 of the read IPC diagnostics module is displayed at this output in the form of the structure ST_MDP_SiliconDrive [▶ 31].

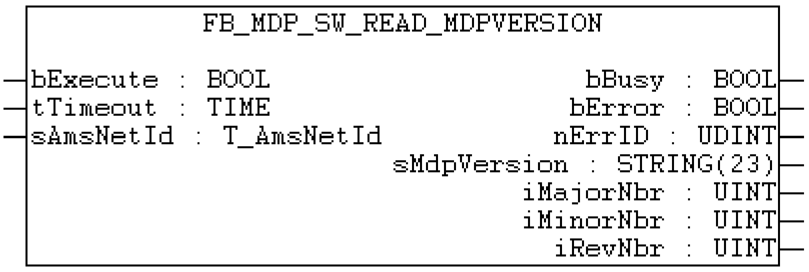
Notice

The querying of the IPC-diagnostics Drive module is one of the more time consuming processes. Hence, the Standard ADS Timeout can by all means be exceeded. This can be remedied by increasing the time period tTimeout applied to the input of the function block.

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

4.3.7 FB_MDP_SW_Read_MdpVersion



The function block enables querying of the MDP version. This information can be found in the software module in the configuration area of the IPC diagnostics.

The MDP version is independent of the PLC library version. The constant stLibVersion_Tc2_MDP [▶ 33] is used to query the PLC library version.

VAR_INPUT

```
VAR_INPUT
    bExecute  : BOOL;           (* Function block execution is triggered by a rising edge at this in
put.*)
    tTimeout  : TIME :=DEFAULT_ADS_TIMEOUT; (* States the time before the function is cancelled. *)
    sAmsNetId : T_AmsNetId;     (* keep empty '' for the local device *)
END_VAR
```

bExecute: The function block is called by a rising edge on the input *bExecute*, if the block is not already active.

tTimeout: Specifies a maximum length of time for the execution of the function block.

sAmsNetId: To execute the query on the local device, it is not necessary to specify this input variable. Alternatively, an empty string can be specified. To direct the query to another computer, its AMS Net Id (of type T_AmsNetId) can be specified here.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy       : BOOL;
    bError      : BOOL;
    nErrID      : UDINT;
    sMdpVersion : STRING(23); (* complete MDP version as string [e.g.: '1, 0, 4, 47'] *)
    iMajorNbr   : UINT;      (* major number [e.g.: 1] *)
    iMinorNbr   : UINT;      (* minor number [e.g.: 4] *)
    iRevNbr     : UINT;      (* revision number [e.g.: 47] *)
END_VAR
```

bBusy: This output is TRUE as long as the function block is active.

bError: Becomes TRUE as soon as an error situation occurs.

nErrID: Returns an error code [▶ 34] if the bError output is set.

sMdpVersion: At this output the queried MDP version is output as a string.

iMajorNbr: The first part of the version number output is *iMajorNbr*.

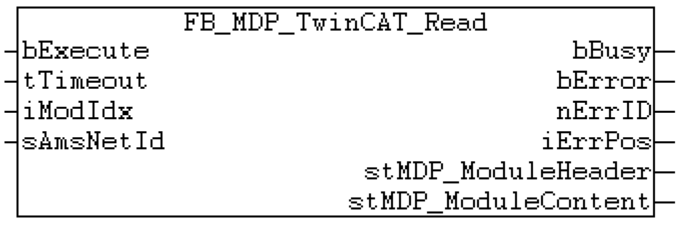
iMinorNbr: The second part of the version number output is *iMinorNbr*.

iRevNbr: The third part of the version number output is *iRevNbr*.

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

4.3.8 FB_MDP_TwinCAT_Read



The function block enables querying of the IPC diagnostics module TwinCAT.

VAR_INPUT

```
VAR_INPUT
    bExecute   : BOOL;         (* Function block execution is triggered by a rising edge at this inpu
t.*)
    tTimeout   : TIME := DEFAULT_ADS_TIMEOUT; (* States the time before the function is cancelled. *)
    iModIdx    : USINT := 0;      (* Index number of chosen MDP module *)
    sAmsNetId  : T_AmsNetId;      (* keep empty '' for the local device *)
END_VAR
```

bExecute: The function block is called by a rising edge on the input *bExecute*, if the block is not already active.

tTimeout: Specifies a maximum length of time for the execution of the function block.

iModIdx: If several instances of an IPC diagnostics module exist, a selection can be made by means of the input iModIdx (0,...,n).

sAmsNetId: To execute the query on the local device, it is not necessary to specify this input variable. Alternatively, an empty string can be specified. To direct the query to another computer, its AMS Net Id (of type T_AmsNetId) can be specified here.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy      : BOOL;
    bError     : BOOL;
    nErrID     : UDINT;
    iErrPos    : USINT;
    stMDP_ModuleHeader  : ST_MDP_ModuleHeader;
    stMDP_ModuleContent : ST_MDP_TwinCAT;
END_VAR
```

bBusy: This output is TRUE as long as the function block is active.

bError: Becomes TRUE as soon as an error situation occurs.

nErrID: Returns an error code [▸ 34] if the bError output is set.

iErrPos: If an error occurred and this refers to an individual element, then this output indicates the position (subindex of the element) at which an error first occurred.

stMDP_ModuleHeader: At this output the header information for the read IPC diagnostics modules is displayed in the form of the structure ST_MDP_ModuleHeader [▸ 30].

stMDP_ModuleContent: The information from TableID 1 of the read IPC diagnostics module is displayed at this output in the form of the structure ST_MDP_TwinCAT [▸ 32].

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

5 Data types

5.1 General data types

5.1.1 E_MDP_AddrArea

```
TYPE E_MDP_AddrArea :(
    eMDP_Area_ConfigArea  := 16#8,
    eMDP_Area_ServiceArea := 16#B,
    eMDP_Area_DeviceArea  := 16#F
);
END_TYPE
```

The enumeration *E_MDP_AddrArea* defines constant values for the different site the IPC diagnostics.

5.1.2 E_MDP_ModuleType

```
TYPE E_MDP_ModuleType :(
    eMDP_ModT_NIC              := 16#0002,
    eMDP_ModT_Time             := 16#0003,
    eMDP_ModT_UserManagement   := 16#0004,
    eMDP_ModT_RAS              := 16#0005,
    eMDP_ModT_FTP              := 16#0006,
    eMDP_ModT_SMB              := 16#0007,
    eMDP_ModT_TwinCAT          := 16#0008,
    eMDP_ModT_Datastore        := 16#0009,
    eMDP_ModT_Software         := 16#000A,
    eMDP_ModT_CPU              := 16#000B,
    eMDP_ModT_Memory           := 16#000C,
    eMDP_ModT_Firewall         := 16#000E,
    eMDP_ModT_FileSystemObject := 16#0010,
    eMDP_ModT_PLC              := 16#0012,
    eMDP_ModT_DisplayDevice    := 16#0013,
    eMDP_ModT_EWF              := 16#0014,
    eMDP_ModT_FBWF             := 16#0015,
    eMDP_ModT_SiliconDrive     := 16#0017,
    eMDP_ModT_OS               := 16#0018,
    eMDP_ModT_Raid             := 16#0019,
    eMDP_ModT_Fan              := 16#001B,
    eMDP_ModT_Mainboard        := 16#001C,
    eMDP_ModT_DiskManagement   := 16#001D,
    eMDP_ModT_UPS              := 16#001E,
    eMDP_ModT_Misc             := 16#0100
);
END_TYPE
```

The enumeration *E_MDP_ModuleType* defines constant values for the different module types in the MDP. A module type can occur several times per device. Hence, a device with two Ethernet interfaces also has two MDP NIC modules.

Detailed information on the modules can be found in the documentation for the IPC diagnostics under module types.

Notice: This module type is not the same as the dynamic module ID!

5.1.3 ST_MDP_Addr

```
TYPE ST_MDP_Addr :
STRUCT
    nArea       : BYTE;      (* Area [range: 0x0-0xF] *)
    nModuleId   : BYTE;      (* Dynamic Module Id [range: 0x00-0xFF] *)
    nTableId    : BYTE;      (* Table Id [range: 0x0-0xF] *)
    nFlag       : BYTE;      (* Flags [range: 0x00-0xFF] *)
    nSubIdx     : BYTE;      (* SubIndex [range: 0x00-0xFF] *)
    arrReserved : ARRAY[0..2] OF BYTE;
END_STRUCT
END_TYPE
```

The structure contains information that is required for the MDP addressing.

nArea: Possible MDP areas are listed in E_MDP_AddrArea [▸ 29].

nModuleId: The Module ID is assigned dynamically. It does not correspond to the module types listed in E_MDP_ModuleType. The function block FB_MDP_ScanModules [▸ 19] can be used in order to determine a dynamic Module ID for a special type of module.

nTableId: This value specifies the number of the selected table of the selected module.

nFlag: This parameter is used internally only. It remains at the default value of 0x00.

nSubIdx: The Subindex parameter corresponds to the subindex in a table in an MDP module.

More detailed information on MDP addressing can be found in the Deive Manager documentation.

5.1.4 ST_MDP_ModuleHeader

```
TYPE ST_MDP_ModuleHeader :
STRUCT
    iLen     :UINT;
    nAddr    :DWORD;
    sType    :T_MaxString;
    sName    :T_MaxString;
    nDevType :DWORD;
END_STRUCT
END_TYPE
```

The structure contains device information. This information always corresponds to the Table ID 0 of an MDP module. Each module possesses this module header.

iLen	Specifies the number of parameters in the Table ID, in this case the module header.
nAddr	Specifies the address of the module.
sType	Specifies the type of module. Possible types are listed in the MDP module list.(Device Manager documentation).
sName	Specifies the name of this MDP module.
nDevType	Specifies the type of MDP module as code.

5.2 Structures specific MDP modules

5.2.1 ST_MDP_CPU

```
TYPE ST_MDP_CPU :
STRUCT
    iLen          : UINT;     (* Length *)
    iCPUfrequency : UDINT;    (* CPU Frequency *)
    iCPUusage     : UINT;     (* Current CPU Usage [%] *)
END_STRUCT
END_TYPE
```

The structure contains information on the IPC diagnostics module CPU.

This complete information can be queried by means of the function block FB_MDP_CPU_Read [▸ 20].

The parameters existing in this structure correspond to the subindices of the first table (Table ID 1) within the IPC-diagnostics CPU module.

5.2.2 ST_MDP_IdentityObject

```
TYPE ST_MDP_IdentityObject :
STRUCT
    iLen         : UINT;      (* Length *)
    iVendor      : UDINT;     (* Vendor *)
    iProductCode : UDINT;     (* Product Code *)      (* not yet supported *)
    iRevNumber    : UDINT;      (* Revision Number *) (* not yet supported *)
    iSerialNumber : UDINT;      (* Serial Number *)
END_STRUCT
END_TYPE
```

The structure contains information on the ‘IdentityObject’ table, which can be found in the IPC diagnostics general area.

This complete information can be queried by means of the function block FB_MDP_IdentityObj_Read [▶ 22].

The parameters in this structure correspond to the subindices of the 'identity object' table in the IPC diagnostics general area.

5.2.3 ST_MDP_NIC_Properties

```
TYPE ST_MDP_NIC_Properties :
STRUCT
    iLen         : UINT;          (* Length *)
    sMACAddress  : T_MaxString;   (* MAC Address *)
    sIPAddress   : T_MaxString;   (* IP Address *)
    sSubnetMask  : T_MaxString;   (* Subnet Mask *)
    bDHCP        : BOOL;          (* DHCP *)
END_STRUCT
END_TYPE
```

The structure contains information on the IPC diagnostics module NIC (Network Interface Card).

This complete information can be queried by means of the function block FB_MDP_NIC_Read [▶ 23].

The parameters existing in this structure correspond to the subindices of the first table (Table ID 1) within the IPC-diagnostics NIC module.

5.2.4 ST_MDP_SiliconDrive

```
TYPE ST_MDP_SiliconDrive :
STRUCT
    iLen                    : UINT;     (* Length *)
    iTotalEraseCounts       : UDINT;    (* Total EraseCounts (lower 4 bytes) *)
    iDriveUsage             : UINT;     (* Drive Usage (%) *)
    iNbrSpares              : UINT;     (* Number of Spares *)
    iNbrUsedSpares          : UINT;     (* Spares Used *)
    iTotalEraseCountsHigh   : UDINT;    (* Total EraseCounts (higher 4 bytes) *)
END_STRUCT
END_TYPE
```

The structure contains information on the MDP SiliconDrive module.

This complete information can be queried by means of the function block FB_MDP_SiliconDrive_Read [▶ 25].

iLen: iLen indicates the number the MDP elements in the table in the MDP module.

iTotalEraseCounts: This value indicates the total number of write and delete cycles of all memory blocks of a Silicon Drive. This number is a 64-bit value. *iTotalEraseCounts* contains the lower 32 bits.

iTotalEraseCountsHigh: This value indicates the total number of write and delete cycles of all memory blocks of a Silicon Drive. This number is a 64-bit value. *iTotalEraseCountsHigh* contains the higher 32 bits.

iDriveUsage: This parameter indicates the calculated wear of the Silicon Drive. The value is based on two million write cycles per block as maximum value.

iNbrSpares: Reserved blocks are used to replace worn memory blocks. *iNbrSpares* indicates the number of spare blocks available on the Silicon Drive.

iNbrUsedSpares: The value indicates the number of spare blocks already in use.

The parameters existing in this structure correspond to the subindices of the first table (Table ID 1) within the IPC diagnostics SiliconDrive module.

Obsolete functionality

The SiliconDrive hardware was replaced by newer memory card types. The functionality is therefore obsolete. We recommend using the query of the IPC diagnostic modulePhysical Drive SMART Parameters instead.

5.2.5 ST_MDP_TwinCAT

```
TYPE ST_MDP_TwinCAT :
STRUCT
    iLen             : UINT;         (* Length *)
    iMajorVersion    : UINT;         (* Major Version *)
    iMinorVersion    : UINT;         (* Minor Version *)
    iBuild           : UINT;         (* Build *)
    sAmsNETid        : T_MaxString;  (* Ams NET ID *)
    iRegLevel        : UDINT;        (* TwinCAT registration level *)
    iStatus          : UINT;         (* TwinCAT status *)
    iRunAsDev        : UINT;         (* Run As Device *)      (* available for WindowsCE *)
    iShowTargetVisu  : UINT;         (* show target visualization *)  (* available for WindowsCE *)
    iLogFileSize     : UDINT;        (* log file size *)      (* available for WindowsCE *)
    sLogFilePath     : T_MaxString;  (* log file path *)      (* available for WindowsCE *)
END_STRUCT
END_TYPE
```

The structure contains information on the MDP TwinCAT module.

This complete information can be queried by means of the function block FB_MDP_TwinCAT_Read [▶ 27].

The parameters existing in this structure correspond to the subindices of the first table (Table ID 1) within the MDP TwinCAT module.

6 Global Constants

6.1 Global_Version

All libraries have a certain version. The version is indicated in the PLC library repository, for example. A global constant contains the information about the library version:

Global_Version

```
VAR_GLOBAL CONSTANT
    stLibVersion_Tc2_MDP : ST_LibVersion;
END_VAR
```

stLibVersion_Tc2_MDP: Version number of the Tc2_MDP library (type: ST_LibVersion).

To check whether the version you have is the version you need, use the function F_CmpLibVersion (defined in Tc2_System library).

All other options for comparing library versions, which you may know from TwinCAT 2, are outdated!

7 Error Codes

7.1 Error codes overview

The function blocks of the Tc2_MDP library have an *nErrID output*. This value is 4 bytes in size and returns the error code in the event of an error. *nErrID* is comprised of two parts:

Error Group (MSB) 2 Byte	Error Code 2 Byte (LSB)
0x EC80	E_MDP_ErrCodesPLC [▶ 35]
0x ECA6	MDP general error
0x ECA7	MDP API error
0x ECA8	ADS error
0x ECAF	MDP module specific error

The function block FB_MDP_SplitErrorID [▶ 20] enables the automatic separation of the variable *nErrID* into error group and error code.

Error Group

The fault group describes the type of error that has occurred. The different groups are listed in the enumeration E_MDP_ErrGroup [▶ 34].
All errors generated within the PLC library have the error group 0xEC80.

Error Code

The error code describes the specific error.
For errors within the PLC library with the error group 0xEC80, the identifiers are listed in the enumeration E_MDP_ErrCodesPLC [▶ 35]. A description of the other error codes can be found in the documentation of the IPC diagnostics in the section on error messages.

General MDP-dependent errors are output in the error group 16#ECA6 “General error codes”. These errors sometimes indicate that an element from the module element list is not available. Example: 16#ECA60105 "No data available" If, in the case of a general or specific function block (see access options), several elements are queried at the same time and one of these elements is not available or exhibits an error, then the output variable iErrPos indicates the index position (0..n) at which the error occurred for the first time. All elements below this index were queried successfully and are indicated despite the generation of an error at the output.

Example:

nErrID = 0x ECA8 0745

The error group is 0x ECA8, therefore it is an Ads error.
The error code is 0x 0745, therefore it is a timeout error.

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

7.2 E_MDP_ErrGroup

```
TYPE E_MDP_ErrGroup :(
    eMDP_Err_NoError        := 16#0000,     (* Success - No Error *)
    eMDP_Err_PLC     := 16#EC80,     (* PLC library internal error codes *)
    eMDP_Err_GenErr     := 16#ECA6,     (* General error codes *)
    eMDP_Err_API     := 16#ECA7,     (* API error codes *)
    eMDP_Err_ADS     := 16#ECA8,     (* ADS error codes *)
    eMDP_Err_ModuleSpecific := 16#ECAF     (* Module specific error codes *)
);
END_TYPE
```

The enumeration *E_MDP_ErrGroup* defines constant values for the different error groups in the MDP. These indicate the type of error.
The values appear in the error codes [▶ 34], which are output by a PLC MDP function block in the event of an error.

A general description can be found in the MDP Information Model in the chapter Return Values. Individual error codes from the error groups 16#ECA6 - 16#ECAF are described there.
The error codes from group 16#EC80 are generated by the PLC MDP library and are described in chapter E_MDP_ErrCodesPLC [▶ 35].

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

7.3 E_MDP_ErrCodesPLC

```
TYPE E_MDP_ErrCodesPLC :(
(* list of PLC library internal error codes *)
    eMDP_ErrPLC_NoError      := 16#0000,
    eMDP_ErrPLC_TimeOut      := 16#0001,
    eMDP_ErrPLC_ModuleNotFound      := 16#0002,
    eMDP_ErrPLC_BufferTooSmall      := 16#0003,
    eMDP_ErrPLC_ElementNotFound      := 16#0004
);
END_TYPE
```

The enumeration *E_MDP_ErrCodesPLC* defines constant values for the different errors that can be generated internally in the library.
These values appear in the error codes [▶ 34], which are output by a PLC MDP function block in the event of an error.

eMDP_ErrPLC_TimeOut	The error *eMDP_ErrPLC_TimeOut* is generated if the time period *tTimeout* applied to the input of the function block has expired. The length of the processing time can vary depending on the MDP query. Due to the internal processes, the processing time can sometimes exceed the Standard ADS Timeout. This can be remedied by increasing the time period tTimeout applied to the input of the function block.
eMDP_ErrPLC_ModuleNotFound	A list of active modules exists in the MDP. The function blocks in the PLC MDP library search this list for the queried module. If the list does not contain the module, then the error *eMDP_ErrPLC_ModuleNotFound* is output. This is the case when the particular module/device is not installed on the system or does not even exist.
eMDP_ErrPLC_BufferTooSmall	If a buffer has been specified at the input of the function block by means of pointers, then it is possible that this is not large enough for the existing data. In this case the error *eMDP_ErrPLC_BufferTooSmall* is output.
eMDP_ErrPLC_ElementNotFound	The query of a certain element was not successful. The element was not found. The respective module or element may not even be present on the system.

A general description can be found in the MDP Information Model.(IPC Diagnosis)

Requirements

Development environment	Target platform	PLC libraries to include
TwinCAT v3.1.0	PC or CX (x86, x64, ARM)	Tc2_MDP

8 Samples

Update: Tc3_IPCDiag library

The TwinCAT 3 PLC library Tc2_MDP is the predecessor to Tc3_IPCDiag. With the new Tc3_IPCDiag library the number of readable parameters has been increased and the user interface has been optimized. It is recommended to use the Tc3_IPCDiag library.
Future extensions will no longer be performed in the Tc2_MDP library. It is not recommended to use the Tc2_MDP library for new projects. All functionalities of the Tc2_MDP library can also be found in the new Tc3_IPCDiag library.

The section Querying CPU data (generic) [▶ 37] describes a sample program for reading the CPU data of the IPC diagnostics via the generic function block FB_MDP_ReadElement. It is designed in such a way that it can be easily extended with the basic knowledge of the MDP information model for access to other IPC diagnosis modules. The sample for Querying the fan status (generic) [▶ 50] is based on the sample program for querying the CPU data.

The section Querying CPU data (specific) [▶ 46] describes a sample program for reading the CPU data of the IPC diagnostics via the specific function block FB_MDP_CPU_Read. The sample cannot be extended for access to other IPC diagnostic modules, e.g. fan data.

Further sample programs are described in the sections Reading IPC serial numbers [▶ 52] and Setting the IP address [▶ 54].

8.1 Querying CPU data (generic)

This sample demonstrates access to CPU data by the IPC diagnostics via the generic function block FB_MDP_ReadElement [▶ 14].

The program is structured in such a way that it can easily be adapted for access to other IPC diagnostics modules. Program lines, which have to be modified to adapt the program to other IPC diagnostics modules, are identified in the comment with the string //**.

Following the program code of the sample you will find the textual Description of the sample program [▶ 38].

Sample: access via the generic function block FB_MDP_ReadElement

Individual CPU data can be read via a subindex in module CPU in the Configuration Area of the IPC diagnostics. The generic function block FB_MDP_ReadElement is used for this purpose.

Enumeration definition

```
//** = simply adjust these lines if modifying code for own purposes

// central definition of state machine states
// (supports easy program modification)
{attribute 'qualified_only'}
TYPE E_State :
(
    Idle,
    ReadCPUusageInit,       //** initiate reading CPU usage
    ReadCPUusageProcess     //** process reading CPU usage
);
END_TYPE
```

Variable Declaration

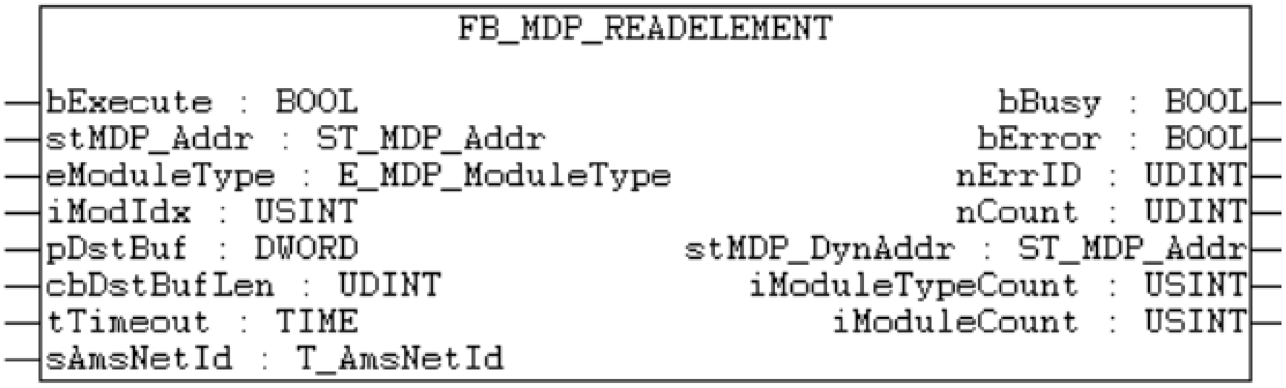
```
PROGRAM MAIN
VAR
    // internal use
    sAmsNetId           : STRING := '';       //** ADS Net ID (local = '')
    eState              : E_State;            // Enum with index for state machine
    bStart              : BOOL := TRUE;       // flag to trigger (re)start of statemachine
    nData               : UINT;               // data storage for unsigned integer
    stMDP_Addr          : ST_MDP_Addr;        // structure will include all address parameters

    // FB instances
    fbReadMDPElement    : FB_MDP_ReadElement; // instance of FB for reading MDP element

    // results of execution
    bError              : BOOL;               // error flag (indicator: error occured)
    nErrID              : UDINT;              // last error ID
    nCpuUsage           : UINT;               // buffer for CPU usage (%)
END_VAR
```

Program code

```
// For an easy re-use of the following code for own purposes, parts of this sample program use
// "general" data names (and copy the results in specific variables after processing the code).

CASE eState OF
    E_State.Idle:
        IF bStart THEN
            bStart := FALSE;
            eState := E_State.ReadCPUusageInit; //** initiate first state
        END_IF

    E_State.ReadCPUusageInit:
        stMDP_Addr.nArea     := INT_TO_BYTE(eMDP_Area_ConfigArea); //
** set area address to "Config Area"
        stMDP_Addr.nTableId := 1;              //** table ID in module for "cpu properties"
        stMDP_Addr.nSubIdx  := 2;              //
** subindex in table ID for "CPU usage"

        fbReadMDPElement(
            bExecute    := TRUE,               // Flag: trigger execution of FB
            eModuleType := eMDP_ModT_CPU,      //** desired module type = CPU
            stMDP_Addr  := stMDP_Addr,         // MDP address structure. Dynamic module ID added int
ernally.
            iModIdx     := 0,                  //
** instance of desired module type (0 = first instance)
            pDstBuf     := ADR(nData),         // buffer for storing data
            cbDstBufLen := SIZEOF(nData),      // length of buffer
            sAmsNetId   := sAmsNetId,          // AMS Net ID
            );                                 //** Note: fbReadMDPElement.tTimeOut must be > cycle
time!

        eState := E_State.ReadCPUusageProcess;  //** next state: process FB

    E_State.ReadCPUusageProcess:                //** process FB: request CPU data
        fbReadMDPElement(bExecute := FALSE);   // Flag: Get execution state of FB
                                               //** Note: fbReadMDPElement.tTimeOut must be > cycle
time!

        IF NOT fbReadMDPElement.bBusy THEN     // FB executed?
            IF fbReadMDPElement.bError THEN    // Error?
                bError    := TRUE;             // set error flag
                nErrID    := fbReadMDPElement.nErrID; // store error id (16#ECA60105 = BIOS or HW do
es
                                               // not support this data (here: mainboard data))
                eState    := E_State.Idle;     // finish state machine
            ELSE                               // set parameters for next steps
                bError    := FALSE;            // turn off error flag
                nCpuUsage := nData;            //** store CPU usage in dedicated variable
                eState    := E_State.ReadCPUusageInit; //** next state
            END_IF
        END_IF

END_CASE
```

Description of the sample program

The function block FB_MDP_ReadElement requires at least the parameters listed below:



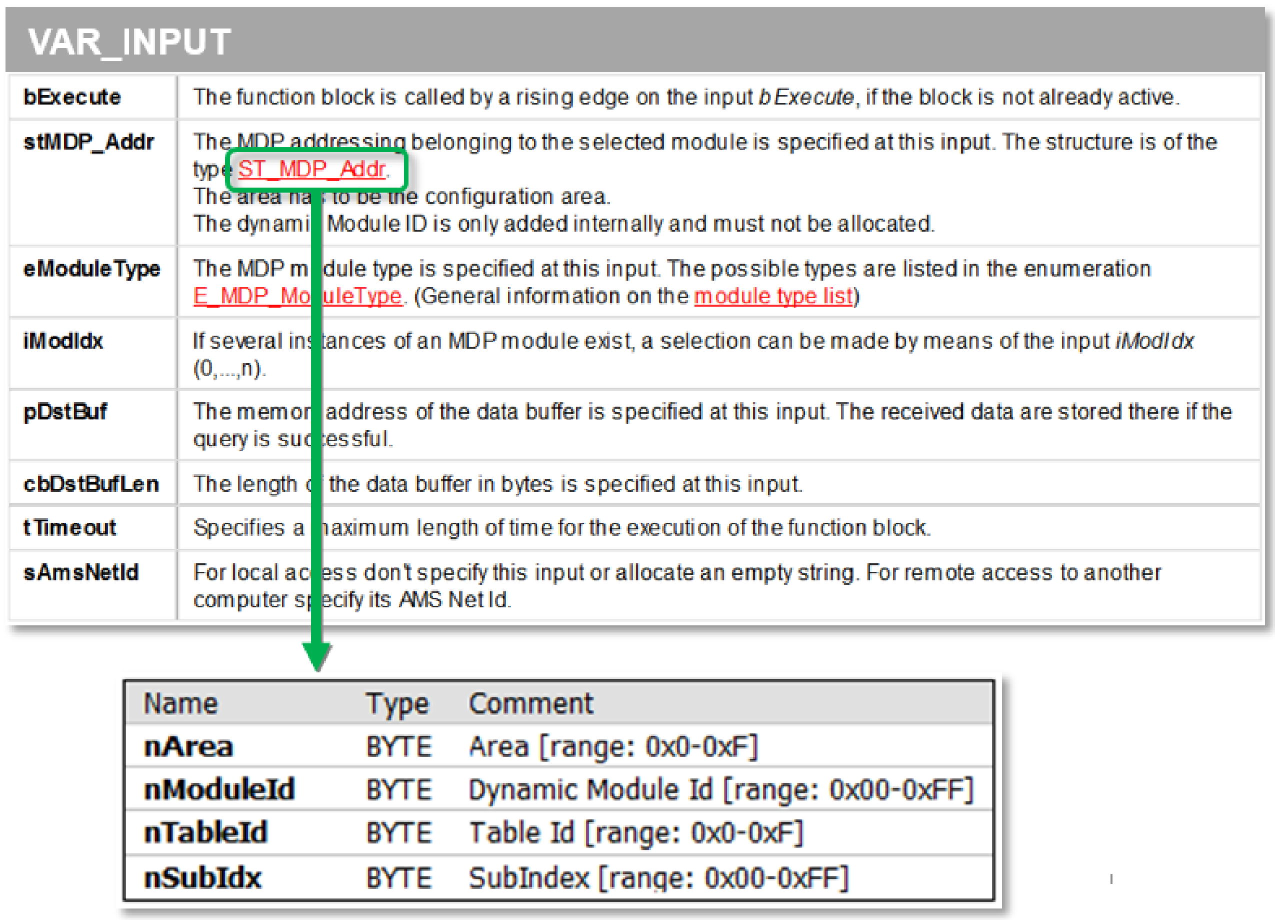
VAR_INPUT	
bExecute	The function block is called by a rising edge on the input *bExecute*, if the block is not already active.
stMDP_Addr	The MDP addressing belonging to the selected module is specified at this input. The structure is of the type ST_MDP_Addr. The area has to be the configuration area. The dynamic Module ID is only added internally and must not be allocated.
eModuleType	The MDP module type is specified at this input. The possible types are listed in the enumeration E_MDP_ModuleType. (General information on the module type list)
iModIdx	If several instances of an MDP module exist, a selection can be made by means of the input *iModIdx* (0,...,n).
pDstBuf	The memory address of the data buffer is specified at this input. The received data are stored there if the query is successful.
cbDstBufLen	The length of the data buffer in bytes is specified at this input.
tTimeout	Specifies a maximum length of time for the execution of the function block.
sAmsNetId	For local access don't specify this input or allocate an empty string. For remote access to another computer specify its AMS Net Id.

- A memory area for the MDP address structure
- The MDP module types
- The address and size of the memory area for the output data of the function block
- The AMS address (AMS Net ID)

The output values of the function block are described here for completeness:

VAR_OUTPUT	
bBusy	This output is TRUE as long as the function block is active.
bError	Becomes TRUE as soon as an error situation occurs.
nErrID	Returns an error code if the bError output is set.
nCount	This output indicates the number of bytes read.
stMDP_DynAddr	The MDP addressing belonging to the selected MDP module is specified at this output. The structure is of the type ST_MDP_Addr. The dynamic Module ID was added by the function block.
iModuleTypeCount	The output *iModuleTypeCount* indicates the number of modules that correspond to the specified type.
iModuleCount	The output *iModuleCount* indicates the entire number of modules on the device.

A very important role is played by the structure for addressing the desired information. It is described by the data type ST_MDP_Addr:

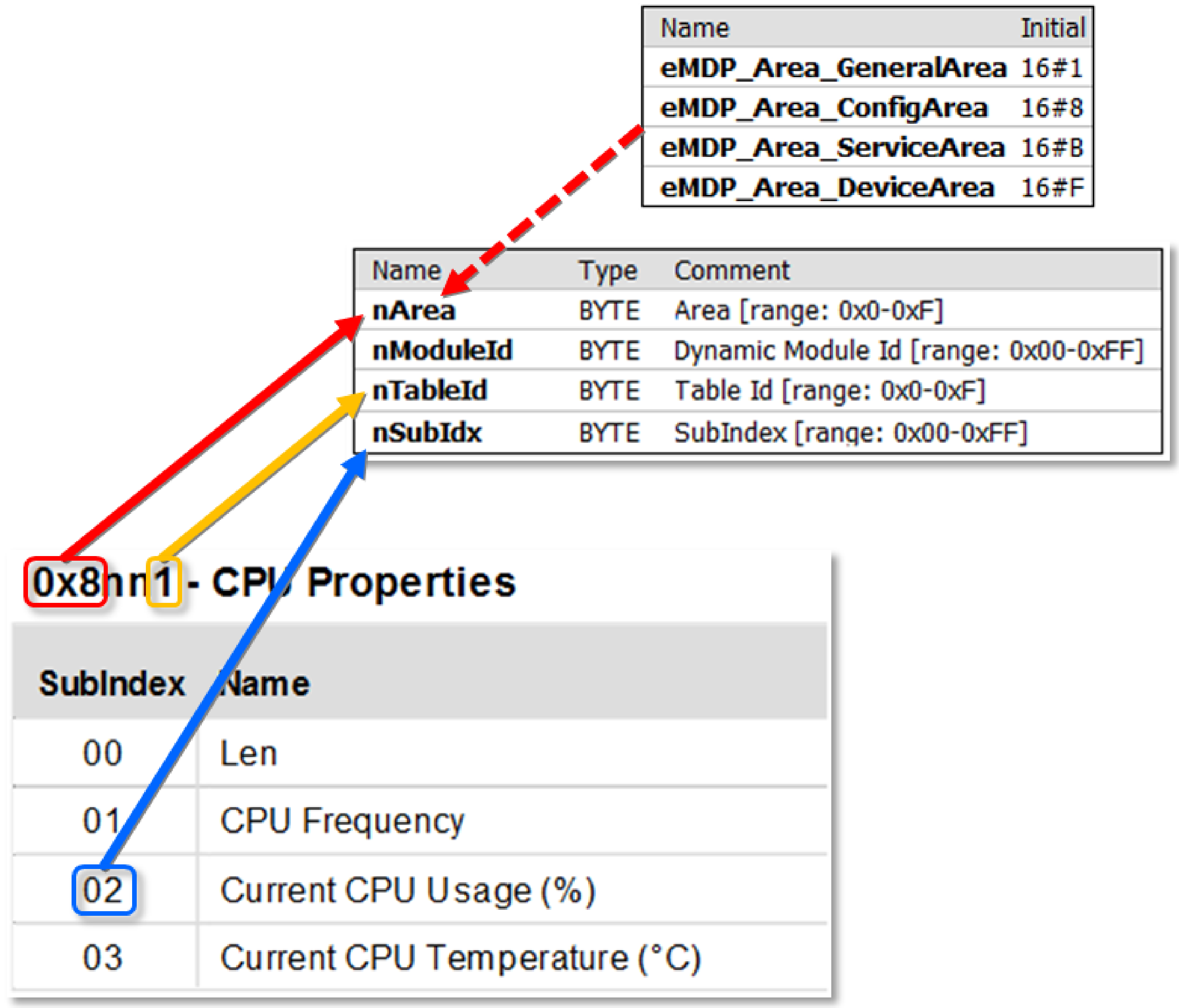


VAR_INPUT	
bExecute	The function block is called by a rising edge on the input *bExecute*, if the block is not already active.
stMDP_Addr	The MDP addressing belonging to the selected module is specified at this input. The structure is of the type ST_MDP_Addr. The area has to be the configuration area. The dynamic Module ID is only added internally and must not be allocated.
eModuleType	The MDP module type is specified at this input. The possible types are listed in the enumeration E_MDP_ModuleType. (General information on the module type list)
iModIdx	If several instances of an MDP module exist, a selection can be made by means of the input *iModIdx* (0,...,n).
pDstBuf	The memory address of the data buffer is specified at this input. The received data are stored there if the query is successful.
cbDstBufLen	The length of the data buffer in bytes is specified at this input.
tTimeout	Specifies a maximum length of time for the execution of the function block.
sAmsNetId	For local access don't specify this input or allocate an empty string. For remote access to another computer specify its AMS Net Id.

Name	Type	Comment
nArea	BYTE	Area [range: 0x0-0xF]
nModuleId	BYTE	Dynamic Module Id [range: 0x00-0xFF]
nTableId	BYTE	Table Id [range: 0x0-0xF]
nSubIdx	BYTE	SubIndex [range: 0x00-0xFF]

There are two possibilities to determine the parameter "nArea":

- The individual areas are stored as enumerations in the Tc2_MDP library. This entry can be used as easily readable input parameter (dashed red arrow).
- The value for the area can alternatively be taken from the index of a table (left-hand 4 bits - red arrow)



Name	Initial
eMDP_Area_GeneralArea	16#1
eMDP_Area_ConfigArea	16#8
eMDP_Area_ServiceArea	16#B
eMDP_Area_DeviceArea	16#F

Name	Type	Comment
nArea	BYTE	Area [range: 0x0-0xF]
nModuleId	BYTE	Dynamic Module Id [range: 0x00-0xFF]
nTableId	BYTE	Table Id [range: 0x0-0xF]
nSubIdx	BYTE	SubIndex [range: 0x00-0xFF]

0x8nn1 - CPU Properties

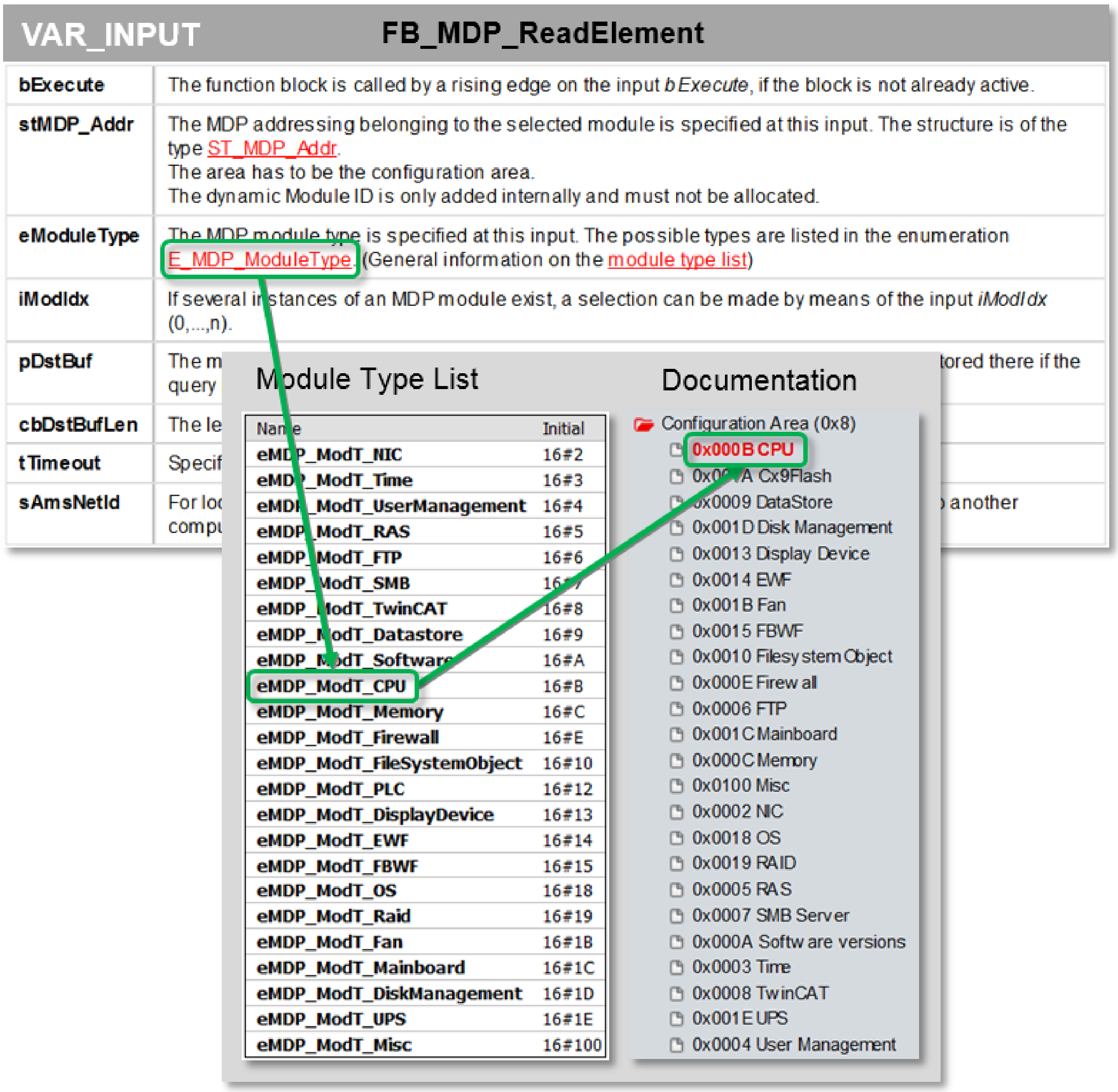
SubIndex	Name
00	Len
01	CPU Frequency
02	Current CPU Usage (%)
03	Current CPU Temperature (°C)

The parameter "nModule" is NOT an input parameter. The module address (=ModuleID) determined by the function block is assigned to it after it has determined the desired module instance.

"nTableId" corresponds to the right-hand 4 bits of the table index (yellow arrow).

"Subindex" is the number of the entry in the table (blue arrow).

The "eModuleType" parameter specifies the type of the module. There is also an enumeration for the module type that can be used for better readability of the program:



VAR_INPUT	FB_MDP_ReadElement
bExecute	The function block is called by a rising edge on the input *bExecute*, if the block is not already active.
stMDP_Addr	The MDP addressing belonging to the selected module is specified at this input. The structure is of the type ST_MDP_Addr. The area has to be the configuration area. The dynamic Module ID is only added internally and must not be allocated.
eModuleType	The MDP module type is specified at this input. The possible types are listed in the enumeration E_MDP_ModuleType. (General information on the module type list)
iModIdx	If several instances of an MDP module exist, a selection can be made by means of the input *iModIdx* (0,...,n).
pDstBuf	The m … tored there if the query
cbDstBufLen	The le
tTimeout	Specif
sAmsNetId	For loc … another compu

Module Type List

Name	Initial
eMDP_ModT_NIC	16#2
eMDP_ModT_Time	16#3
eMDP_ModT_UserManagement	16#4
eMDP_ModT_RAS	16#5
eMDP_ModT_FTP	16#6
eMDP_ModT_SMB	16#7
eMDP_ModT_TwinCAT	16#8
eMDP_ModT_Datastore	16#9
eMDP_ModT_Software	16#A
eMDP_ModT_CPU	16#B
eMDP_ModT_Memory	16#C
eMDP_ModT_Firewall	16#E
eMDP_ModT_FileSystemObject	16#10
eMDP_ModT_PLC	16#12
eMDP_ModT_DisplayDevice	16#13
eMDP_ModT_EWF	16#14
eMDP_ModT_FBWF	16#15
eMDP_ModT_OS	16#18
eMDP_ModT_Raid	16#19
eMDP_ModT_Fan	16#1B
eMDP_ModT_Mainboard	16#1C
eMDP_ModT_DiskManagement	16#1D
eMDP_ModT_UPS	16#1E
eMDP_ModT_Misc	16#100

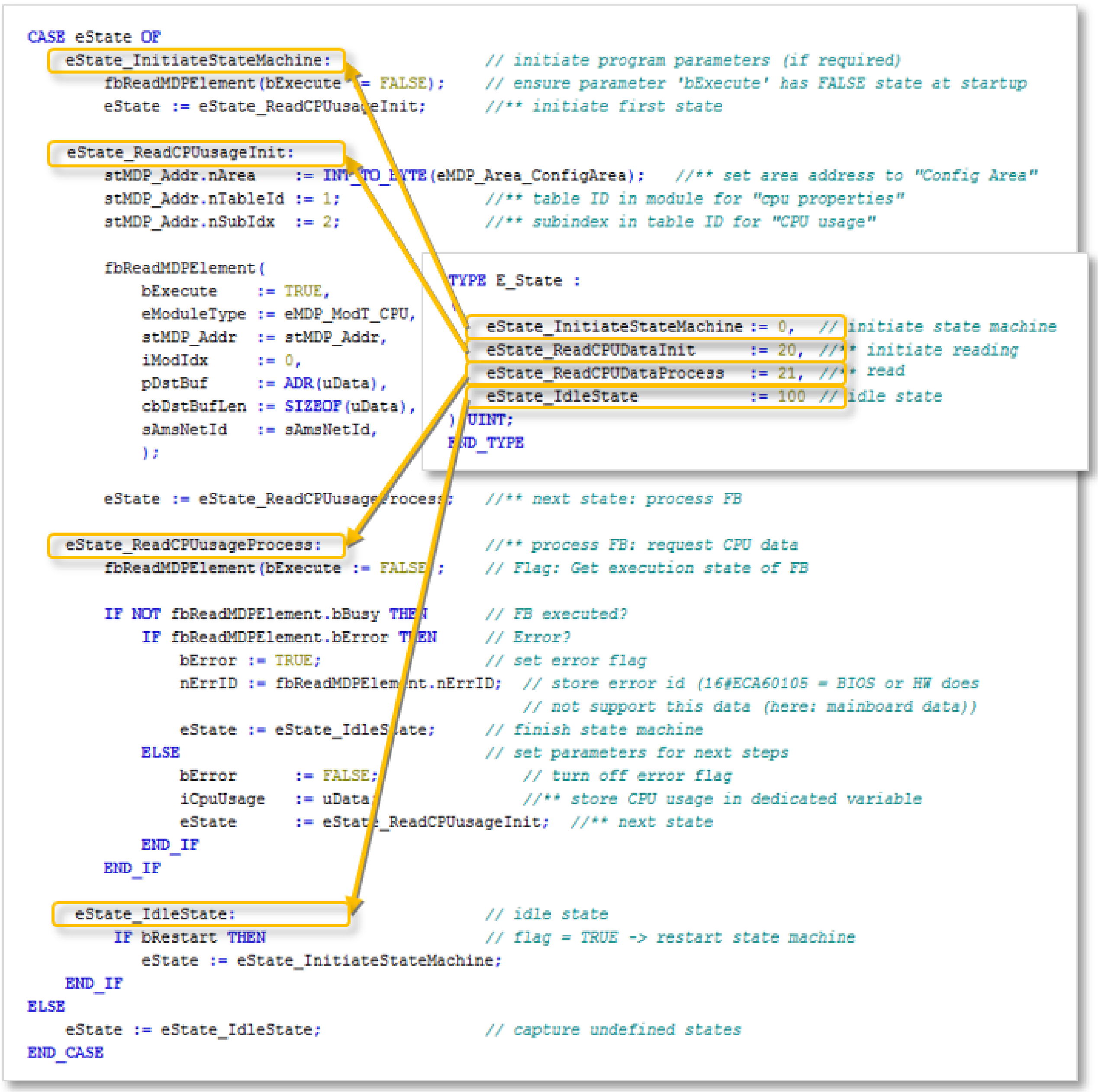
Documentation

- Configuration Area (0x8)
  - 0x000B CPU
  - 0x000A Cx9Flash
  - 0x0009 DataStore
  - 0x001D Disk Management
  - 0x0013 Display Device
  - 0x0014 EWF
  - 0x001B Fan
  - 0x0015 FBWF
  - 0x0010 Filesystem Object
  - 0x000E Firewall
  - 0x0006 FTP
  - 0x001C Mainboard
  - 0x000C Memory
  - 0x0100 Misc
  - 0x0002 NIC
  - 0x0018 OS
  - 0x0019 RAID
  - 0x0005 RAS
  - 0x0007 SMB Server
  - 0x000A Software versions
  - 0x0003 Time
  - 0x0008 TwinCAT
  - 0x001E UPS
  - 0x0004 User Management

Alternatively the value can also be taken from the module description and entered directly.

Structure of the state machine

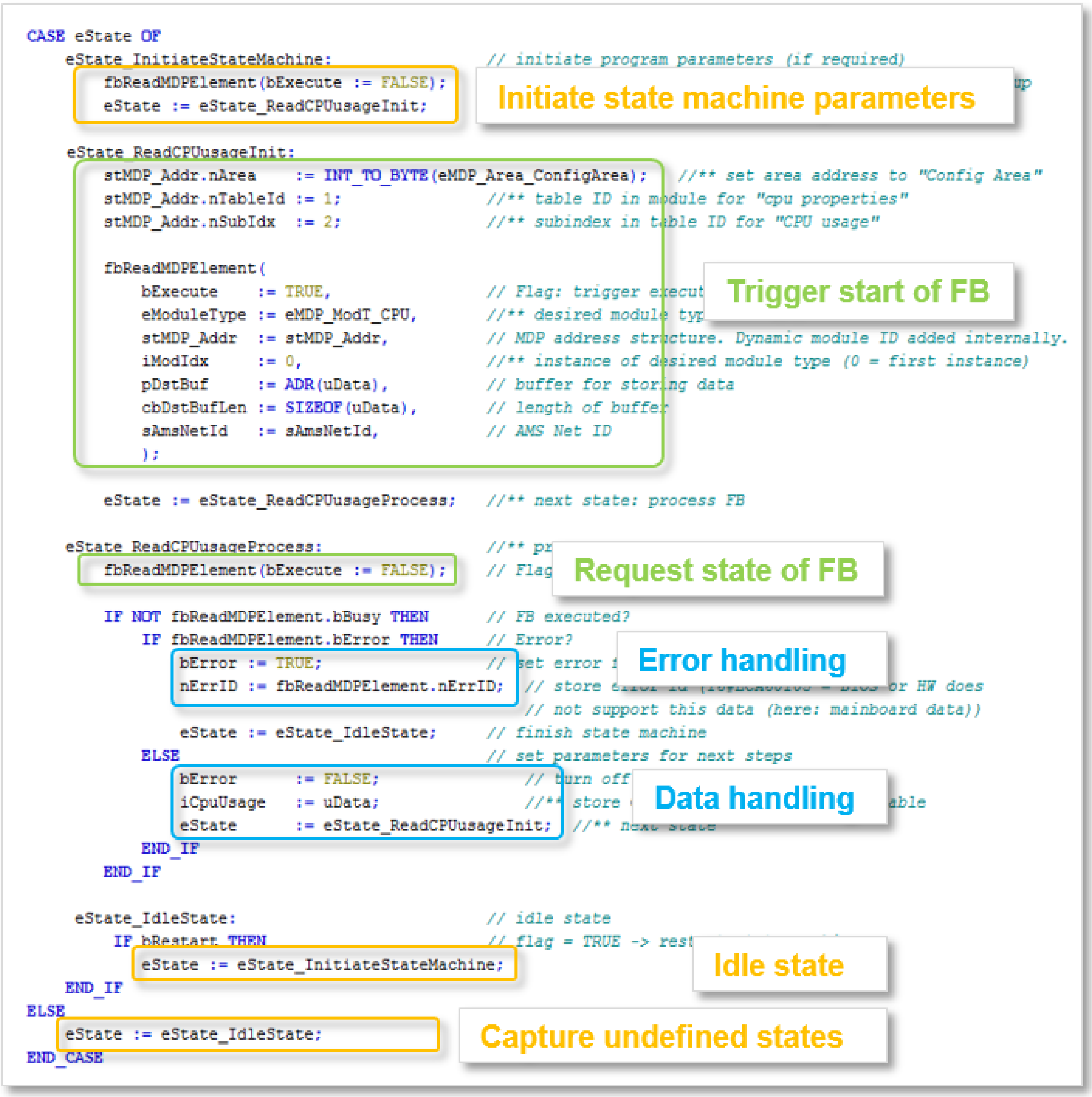
The states of the state machine are defined via enumeration values in a DUT and can thus be adapted or extended centrally and easily.



```
CASE eState OF
    eState_InitiateStateMachine:                    // initiate program parameters (if required)
        fbReadMDPElement(bExecute := FALSE);        // ensure parameter 'bExecute' has FALSE state at startup
        eState := eState_ReadCPUusageInit;          //** initiate first state

    eState_ReadCPUusageInit:
        stMDP_Addr.nArea     := INT_TO_BYTE(eMDP_Area_ConfigArea);  //** set area address to "Config Area"
        stMDP_Addr.nTableId  := 1;                  //** table ID in module for "cpu properties"
        stMDP_Addr.nSubIdx   := 2;                  //** subindex in table ID for "CPU usage"

        fbReadMDPElement(
            bExecute    := TRUE,
            eModuleType := eMDP_ModT_CPU,
            stMDP_Addr  := stMDP_Addr,
            iModIdx     := 0,
            pDstBuf     := ADR(uData),
            cbDstBufLen := SIZEOF(uData),
            sAmsNetId   := sAmsNetId,
            );

        eState := eState_ReadCPUusageProcess;       //** next state: process FB

    eState_ReadCPUusageProcess:                     //** process FB: request CPU data
        fbReadMDPElement(bExecute := FALSE);        // Flag: Get execution state of FB

        IF NOT fbReadMDPElement.bBusy THEN          // FB executed?
            IF fbReadMDPElement.bError THEN         // Error?
                bError := TRUE;                     // set error flag
                nErrID := fbReadMDPElement.nErrID;     // store error id (16#ECA60105 = BIOS or HW does
                                                       // not support this data (here: mainboard data))
                eState := eState_IdleState;         // finish state machine
            ELSE                                    // set parameters for next steps
                bError      := FALSE;                  // turn off error flag
                iCpuUsage   := uData;                  //** store CPU usage in dedicated variable
                eState      := eState_ReadCPUusageInit;   //** next state
            END_IF
        END_IF

    eState_IdleState:                               // idle state
        IF bRestart THEN                            // flag = TRUE -> restart state machine
            eState := eState_InitiateStateMachine;
    END_IF
ELSE
    eState := eState_IdleState;                     // capture undefined states
END_CASE
```

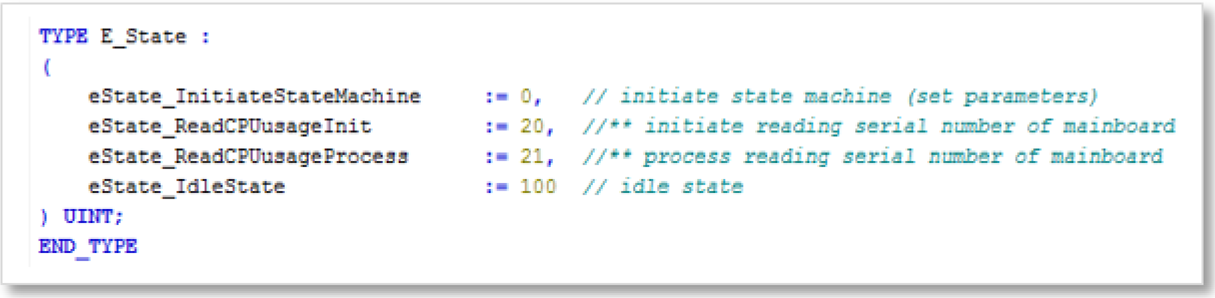
```
TYPE E_State :
(
    eState_InitiateStateMachine := 0,   // initiate state machine
    eState_ReadCPUDataInit      := 20,  //** initiate reading
    eState_ReadCPUDataProcess   := 21,  //** read
    eState_IdleState            := 100  // idle state
) UINT;
END_TYPE
```

Functional areas of the state machine

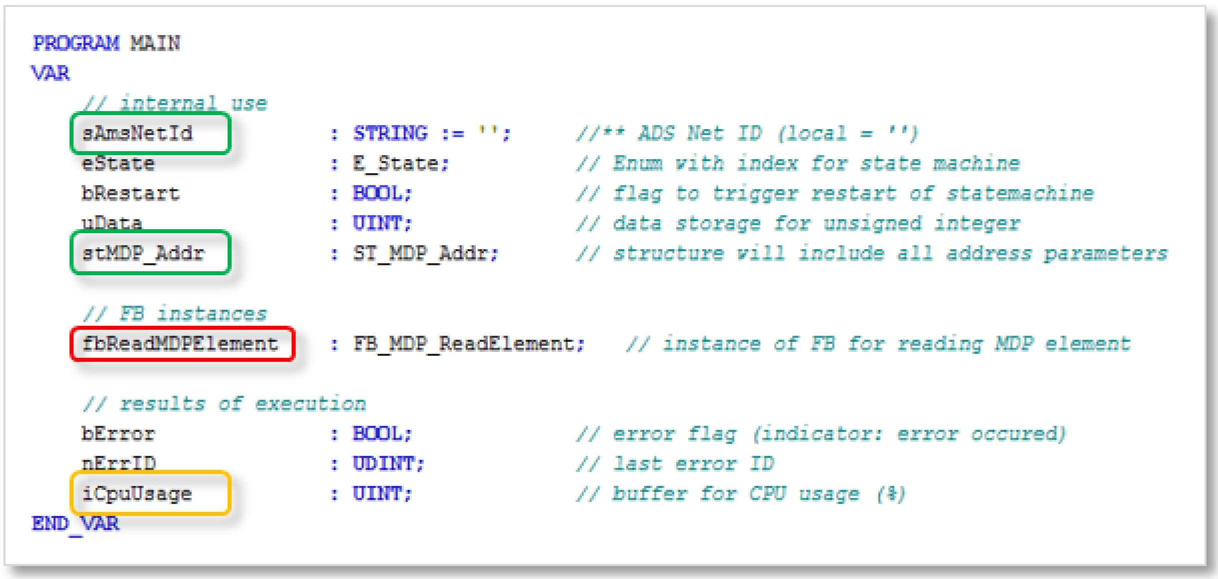


```
CASE eState OF
    eState_InitiateStateMachine:                  // initiate program parameters (if required)
        fbReadMDPElement(bExecute := FALSE);                                                      up
        eState := eState_ReadCPUusageInit;

    eState_ReadCPUusageInit:
        stMDP_Addr.nArea     := INT_TO_BYTE(eMDP_Area_ConfigArea);  //** set area address to "Config Area"
        stMDP_Addr.nTableId := 1;                  //** table ID in module for "cpu properties"
        stMDP_Addr.nSubIdx   := 2;                 //** subindex in table ID for "CPU usage"

        fbReadMDPElement(
            bExecute      := TRUE,                 // Flag: trigger execut
            eModuleType := eMDP_ModT_CPU,          //** desired module typ
            stMDP_Addr    := stMDP_Addr,           // MDP address structure. Dynamic module ID added internally.
            iModIdx       := 0,                    //** instance of desired module type (0 = first instance)
            pDstBuf       := ADR(uData),           // buffer for storing data
            cbDstBufLen := SIZEOF(uData),          // length of buffer
            sAmsNetId     := sAmsNetId,            // AMS Net ID
            );

        eState := eState_ReadCPUusageProcess;     //** next state: process FB

    eState_ReadCPUusageProcess:                   //** pr
        fbReadMDPElement(bExecute := FALSE);      // Flag

        IF NOT fbReadMDPElement.bBusy THEN        // FB executed?
            IF fbReadMDPElement.bError THEN       // Error?
                bError := TRUE;                    // set error f
                nErrID := fbReadMDPElement.nErrID;  // store                                  or HW does
                                                    // not support this data (here: mainboard data))
                eState := eState_IdleState;       // finish state machine
            ELSE                                  // set parameters for next steps
                bError       := FALSE;              // turn off
                iCpuUsage    := uData;              //** store                                able
                eState       := eState_ReadCPUusageInit;  //**
            END_IF
        END_IF

     eState_IdleState:                            // idle state
       IF bRestart THEN                           // flag = TRUE -> rest
         eState := eState_InitiateStateMachine;
    END_IF
ELSE
    eState := eState_IdleState;
END_CASE
```

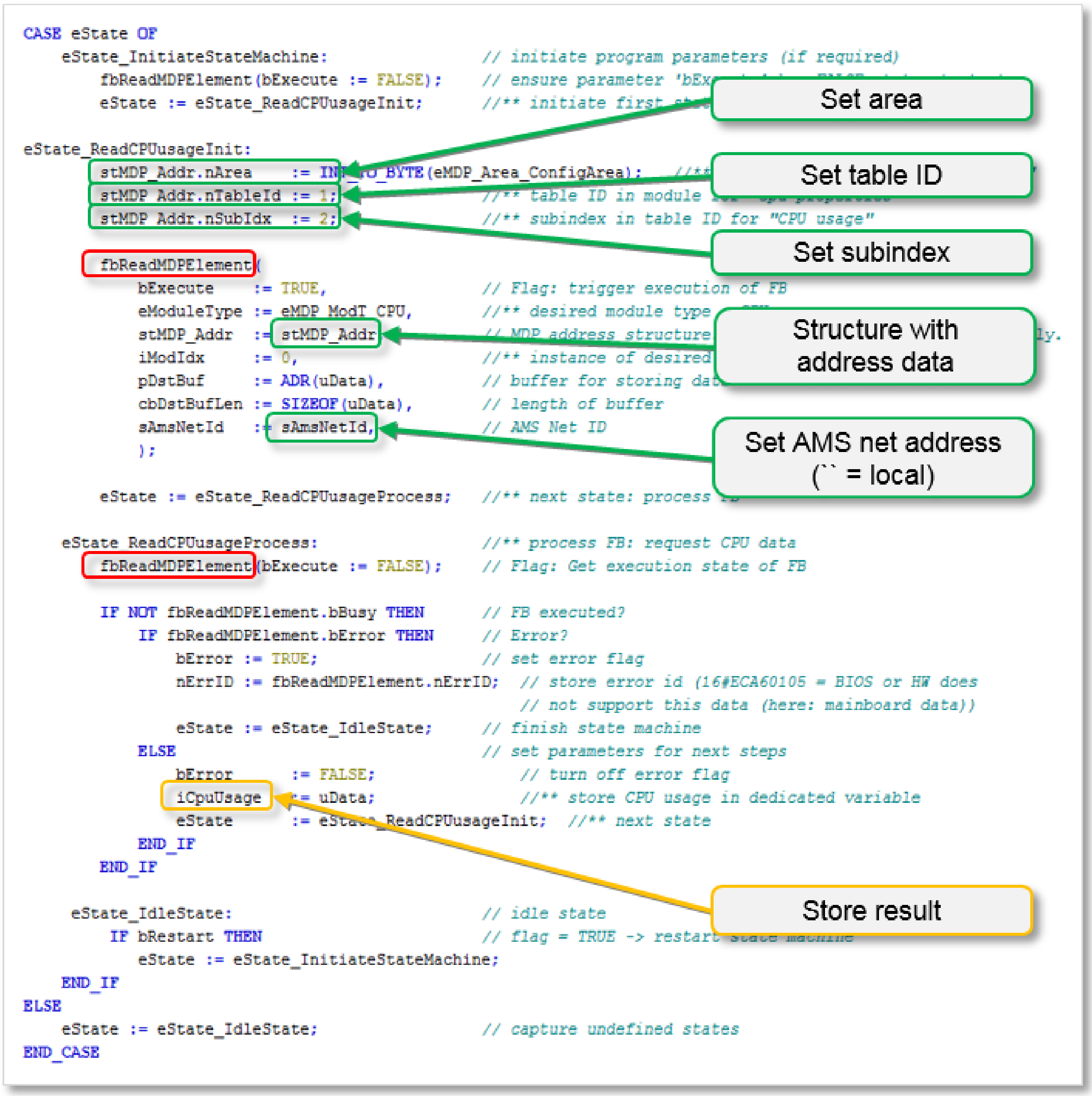
Input and output parameters of the sample program



```
TYPE E_State :
(
    eState_InitiateStateMachine      := 0,   // initiate state machine (set parameters)
    eState_ReadCPUusageInit          := 20,  //** initiate reading serial number of mainboard
    eState_ReadCPUusageProcess       := 21,  //** process reading serial number of mainboard
    eState_IdleState                 := 100  // idle state
) UINT;
END_TYPE
```



```
PROGRAM MAIN
VAR
    // internal use
    sAmsNetId           : STRING := '';     //** ADS Net ID (local = '')
    eState              : E_State;          // Enum with index for state machine
    bRestart            : BOOL;             // flag to trigger restart of statemachine
    uData               : UINT;             // data storage for unsigned integer
    stMDP_Addr          : ST_MDP_Addr;      // structure will include all address parameters

    // FB instances
    fbReadMDPElement    : FB_MDP_ReadElement;   // instance of FB for reading MDP element

    // results of execution
    bError              : BOOL;             // error flag (indicator: error occured)
    nErrID              : UDINT;            // last error ID
    iCpuUsage           : UINT;             // buffer for CPU usage (%)
END_VAR
```



```
CASE eState OF
    eState_InitiateStateMachine:                // initiate program parameters (if required)
        fbReadMDPElement(bExecute := FALSE);    // ensure parameter 'bEx
        eState := eState_ReadCPUusageInit;      //** initiate first st

eState_ReadCPUusageInit:
        stMDP_Addr.nArea     := IN  _BYTE(eMDP_Area_ConfigArea);   //**
        stMDP_Addr.nTableId  := 1;              //** table ID in module
        stMDP_Addr.nSubIdx   := 2;              //** subindex in table ID for "CPU usage"

        fbReadMDPElement(
            bExecute    := TRUE,                // Flag: trigger execution of FB
            eModuleType := eMDP_ModT_CPU,       //** desired module type
            stMDP_Addr  := stMDP_Addr,          // MDP address structure                 ly.
            iModIdx     := 0,                   //** instance of desired
            pDstBuf     := ADR(uData),          // buffer for storing dat
            cbDstBufLen := SIZEOF(uData),       // length of buffer
            sAmsNetId   := sAmsNetId,           // AMS Net ID
            );

        eState := eState_ReadCPUusageProcess;   //** next state: process

    eState_ReadCPUusageProcess:                 //** process FB: request CPU data
        fbReadMDPElement(bExecute := FALSE);    // Flag: Get execution state of FB

        IF NOT fbReadMDPElement.bBusy THEN      // FB executed?
            IF fbReadMDPElement.bError THEN     // Error?
                bError := TRUE;                 // set error flag
                nErrID := fbReadMDPElement.nErrID;  // store error id (16#ECA60105 = BIOS or HW does
                                                    // not support this data (here: mainboard data))
                eState := eState_IdleState;     // finish state machine
            ELSE                                // set parameters for next steps
                bError      := FALSE;               // turn off error flag
                iCpuUsage   := uData;               //** store CPU usage in dedicated variable
                eState      := eState_ReadCPUusageInit;  //** next state
            END_IF
        END_IF

     eState_IdleState:                          // idle state
         IF bRestart THEN                       // flag = TRUE -> restart
            eState := eState_InitiateStateMachine;
    END_IF
ELSE
    eState := eState_IdleState;                 // capture undefined states
END_CASE
```

8.2 Querying CPU data (specific)

This sample demonstrates access to CPU data by the IPC diagnostics via the specific function block FB_MDP_CPU_Read [⏵ 20].

This sample cannot be modified for access to other IPC diagnostics modules such as fan data.

Following the program code of the sample you will find the textual Description of the sample program [⏵ 47].

Sample: access via the specific function block FB_MDP_CPU_Read

The specific function block FB_MDP_CPU_Read facilitates access to selected data of the CPU module in the Configuration Area of the IPC diagnostics.

Enumeration definition

```
//** = simply adjust these lines if modifying code for own purposes

// central definition of state machine states
// (supports easy program modification)
{attribute 'qualified_only'}
TYPE E_State :
(
    Idle,
    ReadCPUDataInit,         //** initiate reading CPU data
    ReadCPUDataProcess       //** process reading CPU data
);
END_TYPE
```

Variable Declaration

```
PROGRAM MAIN
VAR
    // internal use
    sAmsNetId           : STRING := '';       //** ADS Net ID (local = '')
    eState              : E_State;            // Enum with index for state machine
    bStart              : BOOL := TRUE;       // flag to trigger (re)start of statemachine

    // FB instances
    fbReadCPUData       : FB_MDP_CPU_Read;    // instance of FB for reading CPU data

    // results of execution
    bError              : BOOL;               // error flag (indicator: error occured)
    nErrID              : UDINT;              // last error ID
    stHeaderCpuMod      : ST_MDP_ModuleHeader; // buffer for header data of CPU module
    stCPUData           : ST_MDP_CPU;         // structure which will contain CPU data
END_VAR
```

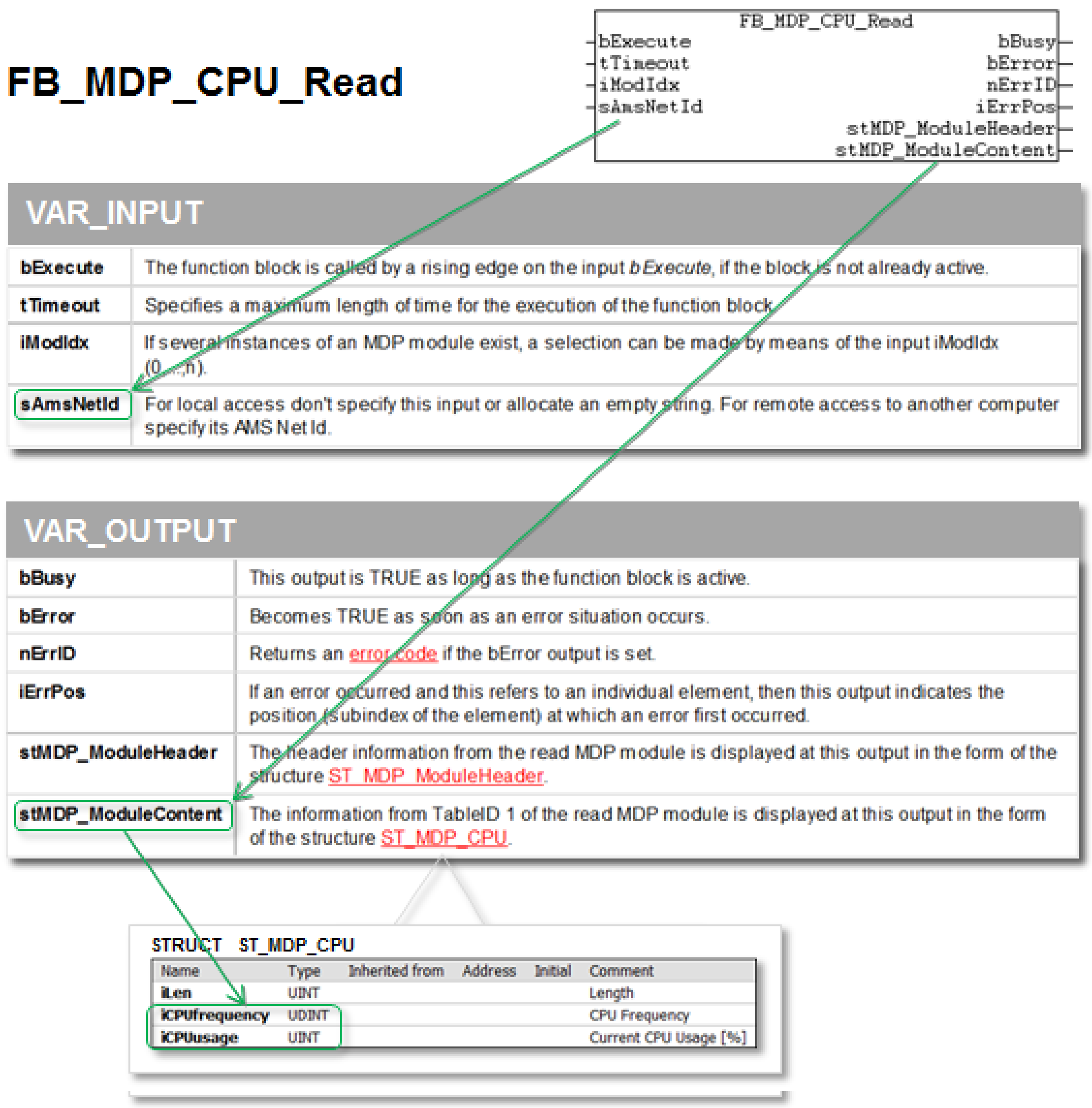
Program code

```
// For an easy reuse of the following code for own purposes, parts of this sample program use
// "general" data names (and copy the results in specific variables after processing the code).

CASE eState OF
    E_State.Idle:
        IF bStart THEN
            bStart := FALSE;
            eState := E_State.ReadCPUDataInit; //** initiate first state
        END_IF

    E_State.ReadCPUDataInit:                   //** trigger FB: request CPU data
        fbReadCPUData(
            bExecute    := TRUE,               // Flag: trigger execution of FB
            iModIdx     := 0,                  //
** Instance of desired module type (0 = first instance)
            sAmsNetId   := sAmsNetId);         // AMS Net ID

        eState := E_State.ReadCPUDataProcess;  //** next state: process FB

    E_State.ReadCPUDataProcess:                //** process FB: request CPU data
        fbReadCPUData(bExecute := FALSE);      // Flag: Get execution state of FB

        IF NOT fbReadCPUData.bBusy THEN        // FB executed?
            IF fbReadCPUData.bError THEN       // Error?
                bError := TRUE;                // set error flag
                nErrID := fbReadCPUData.nErrID; // store error id
                eState := E_State.Idle;         // finish state machine
            ELSE                               // set parameters for next steps
                bError         := FALSE;       // turn off error flag
                stHeaderCpuMod := fbReadCPUData.stMDP_ModuleHeader;  //
** store CPU module header data
                stCPUData      := fbReadCPUData.stMDP_ModuleContent; //** store CPU data
                eState         := E_State.ReadCPUDataInit;           //** read next set of CPU data
            END_IF
        END_IF

END_CASE
```

Description of the sample program

The function block "FB_MDP_CPU_READ" requires a minimum of two parameters:

- The AMS Net ID as input parameter for the address of the IPC (local: ‘’)
- A structure stMDP_ModuleContent that contains the data after calling the function block.



VAR_INPUT

bExecute	The function block is called by a rising edge on the input *bExecute*, if the block is not already active.
tTimeout	Specifies a maximum length of time for the execution of the function block
iModIdx	If several instances of an MDP module exist, a selection can be made by means of the input iModIdx (0...,n).
sAmsNetId	For local access don't specify this input or allocate an empty string. For remote access to another computer specify its AMS Net Id.

VAR_OUTPUT

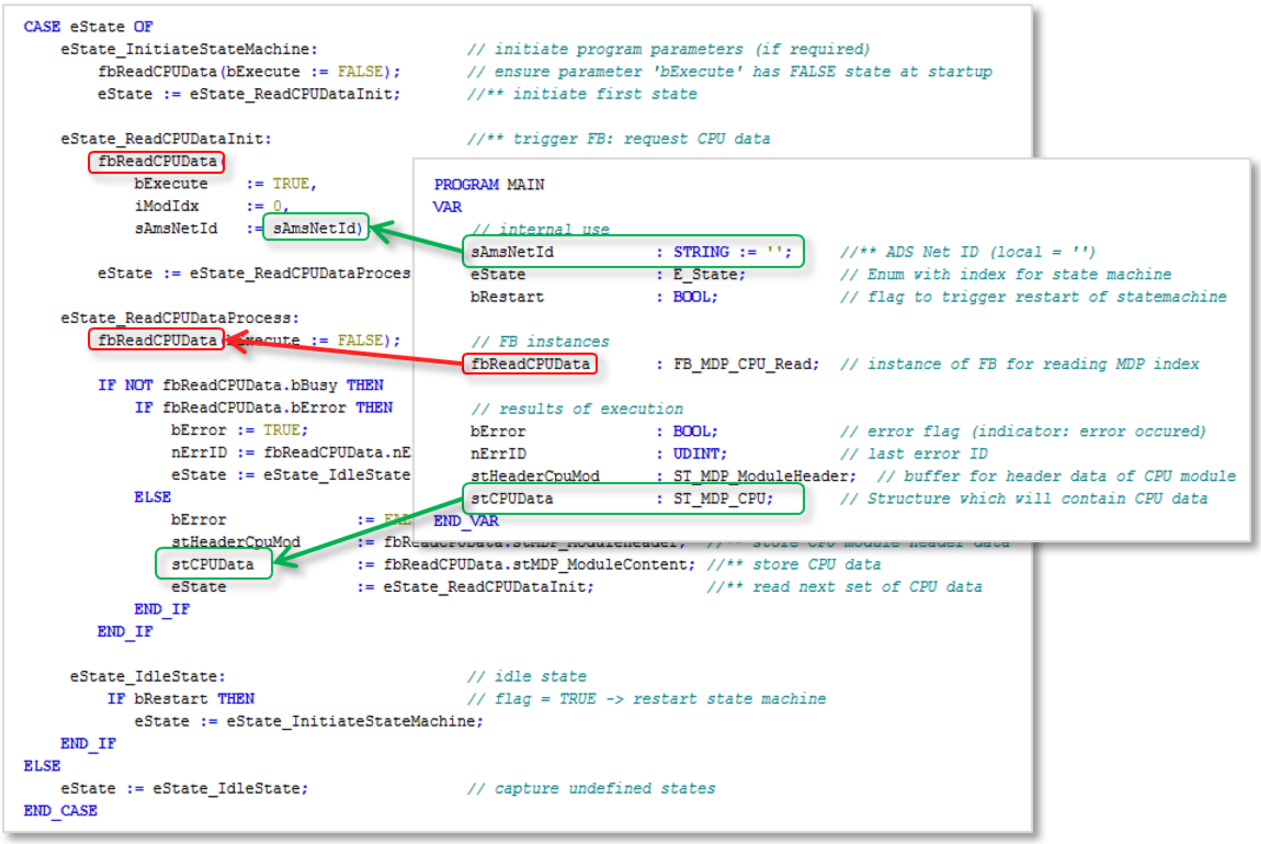
bBusy	This output is TRUE as long as the function block is active.
bError	Becomes TRUE as soon as an error situation occurs.
nErrID	Returns an error code if the bError output is set.
iErrPos	If an error occurred and this refers to an individual element, then this output indicates the position (subindex of the element) at which an error first occurred.
stMDP_ModuleHeader	The header information from the read MDP module is displayed at this output in the form of the structure ST_MDP_ModuleHeader.
stMDP_ModuleContent	The information from TableID 1 of the read MDP module is displayed at this output in the form of the structure ST_MDP_CPU.

STRUCT ST_MDP_CPU

Name	Type	Inherited from	Address	Initial	Comment
iLen	UINT				Length
iCPUfrequency	UDINT				CPU Frequency
iCPUusage	UINT				Current CPU Usage [%]

the function block does not supply the CPU temperature; this can only be read via the generic sample program. The value "CPU temperature" is not supported by all IPCs.

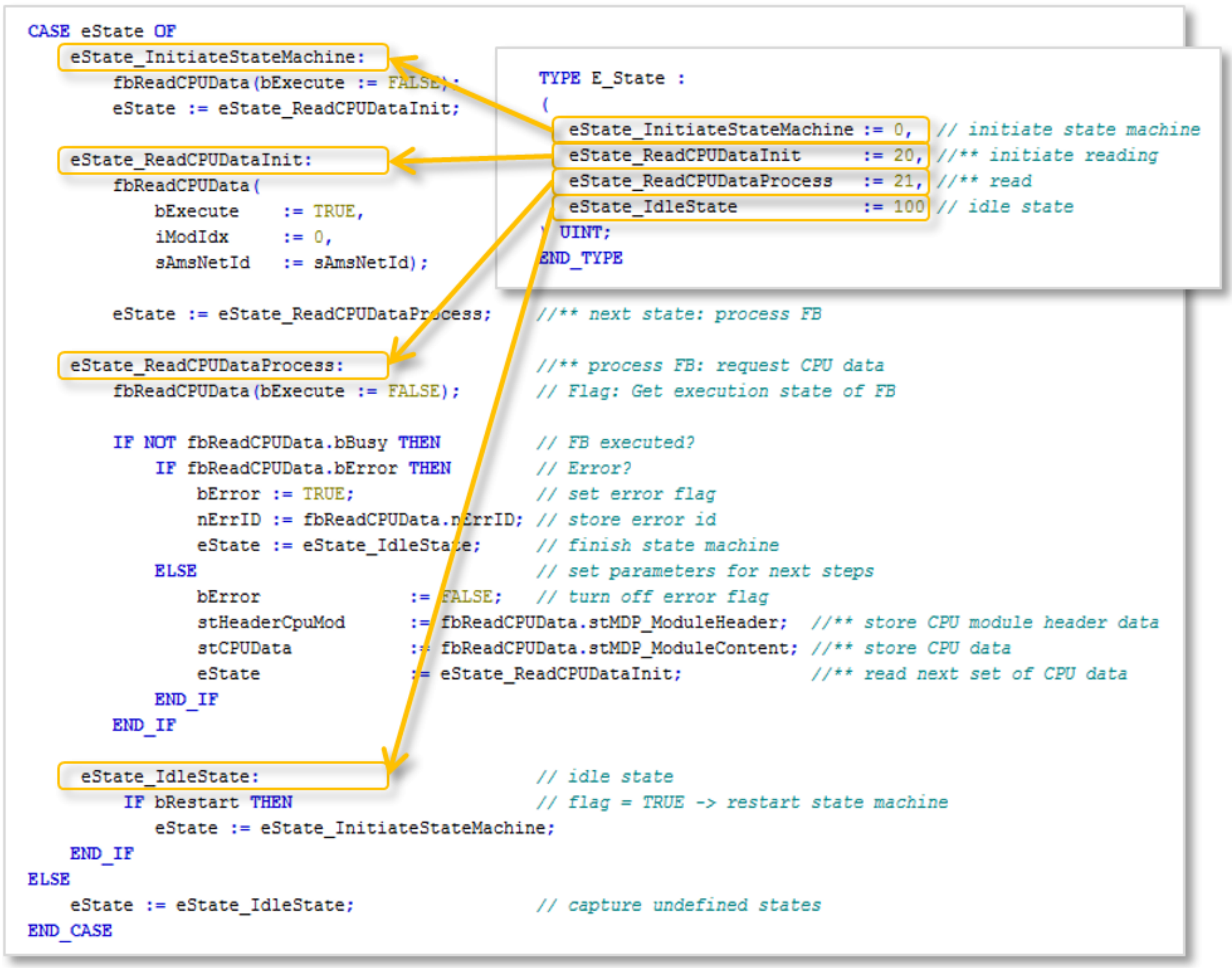
The parameters and the function block are used at these points in the program:



```
CASE eState OF
    eState_InitiateStateMachine:                // initiate program parameters (if required)
        fbReadCPUData(bExecute := FALSE);       // ensure parameter 'bExecute' has FALSE state at startup
        eState := eState_ReadCPUDataInit;       //** initiate first state

    eState_ReadCPUDataInit:                     //** trigger FB: request CPU data
        fbReadCPUData(
            bExecute     := TRUE,
            iModIdx      := 0,
            sAmsNetId    := sAmsNetId)

        eState := eState_ReadCPUDataProces

    eState_ReadCPUDataProcess:
        fbReadCPUData(bExecute := FALSE);

        IF NOT fbReadCPUData.bBusy THEN
            IF fbReadCPUData.bError THEN
                bError := TRUE;
                nErrID := fbReadCPUData.nE
                eState := eState_IdleState
            ELSE
                bError              := FAL
                stHeaderCpuMod      := fbReadCPUData.stMDP_ModuleHeader; //** store CPU module header data
                stCPUData           := fbReadCPUData.stMDP_ModuleContent; //** store CPU data
                eState              := eState_ReadCPUDataInit;            //** read next set of CPU data
            END_IF
        END_IF

     eState_IdleState:                          // idle state
         IF bRestart THEN                       // flag = TRUE -> restart state machine
            eState := eState_InitiateStateMachine;
    END_IF
ELSE
    eState := eState_IdleState;                 // capture undefined states
END_CASE
```

```
PROGRAM MAIN
VAR
    // internal use
    sAmsNetId           : STRING := '';     //** ADS Net ID (local = '')
    eState              : E_State;          // Enum with index for state machine
    bRestart            : BOOL;             // flag to trigger restart of statemachine

    // FB instances
    fbReadCPUData       : FB_MDP_CPU_Read;  // instance of FB for reading MDP index

    // results of execution
    bError              : BOOL;             // error flag (indicator: error occured)
    nErrID              : UDINT;            // last error ID
    stHeaderCpuMod      : ST_MDP_ModuleHeader;  // buffer for header data of CPU module
    stCPUData           : ST_MDP_CPU;       // Structure which will contain CPU data
END_VAR
```

The state machine

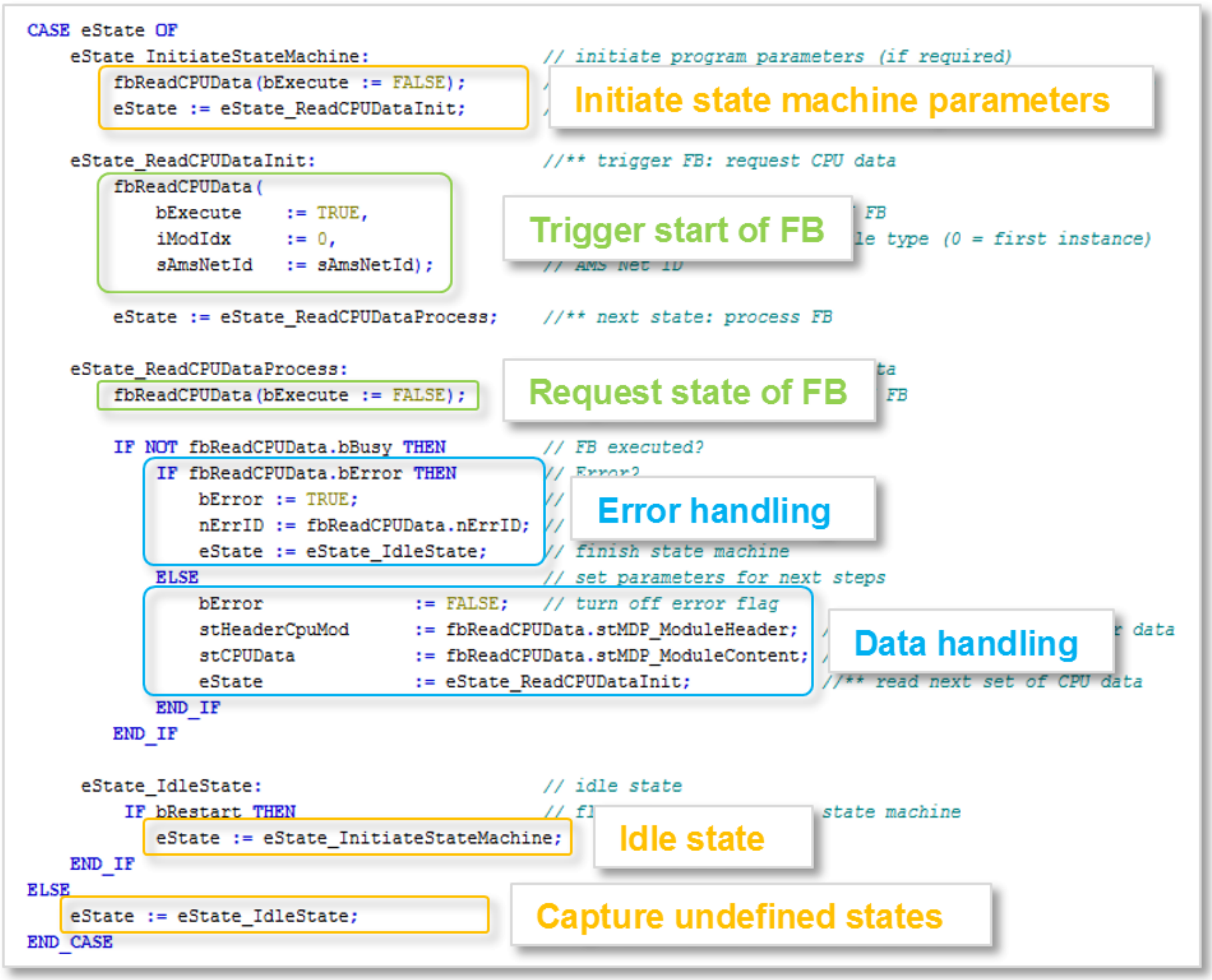


```
TYPE E_State :
(
    eState_InitiateStateMachine := 0,    // initiate state machine
    eState_ReadCPUDataInit      := 20,   //** initiate reading
    eState_ReadCPUDataProcess   := 21,   //** read
    eState_IdleState            := 100   // idle state
) UINT;
END_TYPE
```

```
CASE eState OF
    eState_InitiateStateMachine:
        fbReadCPUData(bExecute := FALSE);
        eState := eState_ReadCPUDataInit;

    eState_ReadCPUDataInit:
        fbReadCPUData(
            bExecute    := TRUE,
            iModIdx     := 0,
            sAmsNetId   := sAmsNetId);

        eState := eState_ReadCPUDataProcess;    //** next state: process FB

    eState_ReadCPUDataProcess:                  //** process FB: request CPU data
        fbReadCPUData(bExecute := FALSE);       // Flag: Get execution state of FB

        IF NOT fbReadCPUData.bBusy THEN         // FB executed?
            IF fbReadCPUData.bError THEN        // Error?
                bError := TRUE;                 // set error flag
                nErrID := fbReadCPUData.nErrID; // store error id
                eState := eState_IdleState;     // finish state machine
            ELSE                                // set parameters for next steps
                bError          := FALSE;       // turn off error flag
                stHeaderCpuMod  := fbReadCPUData.stMDP_ModuleHeader;  //** store CPU module header data
                stCPUData       := fbReadCPUData.stMDP_ModuleContent; //** store CPU data
                eState          := eState_ReadCPUDataInit;            //** read next set of CPU data
            END_IF
        END_IF

    eState_IdleState:                           // idle state
         IF bRestart THEN                       // flag = TRUE -> restart state machine
            eState := eState_InitiateStateMachine;
    END_IF
ELSE
    eState := eState_IdleState;                 // capture undefined states
END_CASE
```

The states of the state machine are listed as constants in order to enable simple adaptation of the program. The desired "State" value thus only needs to be centrally changed once. The statuses are defined as enumeration declarations in the PLC project in subfolder "DUTs" as DUT under the name "E-State".

The various areas of the state machine and their functions are explained below:



```
CASE eState OF
    eState_InitiateStateMachine:                // initiate program parameters (if required)
        fbReadCPUData(bExecute := FALSE);
        eState := eState_ReadCPUDataInit;

    eState_ReadCPUDataInit:                     //** trigger FB: request CPU data
        fbReadCPUData(
            bExecute    := TRUE,                                 FB
            iModIdx     := 0,                                   le type (0 = first instance)
            sAmsNetId   := sAmsNetId);                  // AMS Net ID

        eState := eState_ReadCPUDataProcess;    //** next state: process FB

    eState_ReadCPUDataProcess:                                   ta
        fbReadCPUData(bExecute := FALSE);                        FB

        IF NOT fbReadCPUData.bBusy THEN         // FB executed?
            IF fbReadCPUData.bError THEN        // Error?
                bError := TRUE;                 //
                nErrID := fbReadCPUData.nErrID; //
                eState := eState_IdleState;     // finish state machine
            ELSE                                // set parameters for next steps
                bError              := FALSE;    // turn off error flag
                stHeaderCpuMod      := fbReadCPUData.stMDP_ModuleHeader;     r data
                stCPUData           := fbReadCPUData.stMDP_ModuleContent;
                eState              := eState_ReadCPUDataInit;  //** read next set of CPU data
            END_IF
        END_IF

     eState_IdleState:                          // idle state
         IF bRestart THEN                       // fl            state machine
            eState := eState_InitiateStateMachine;
    END_IF
ELSE
    eState := eState_IdleState;
END_CASE
```

8.3 Querying the fan state (generic)

This sample illustrates access to the fan speed data via the generic function block FB_MDP_ReadElement [▶ 14]. It can be used to diagnose a fan failure (fan speed = 0).

A prerequisite is the presence of a fan. If no fan is available in the IPC, the IPC does not support the addressed module type, and the access attempt results in the error message 16#EC800002.

The contents of the FAN module are described in the Configuration Area of the IPC diagnostics. The generic function block FB_MDP_ReadElement is used for the access.

A description of the structure of this sample program can be found in the sample: Querying CPU data (generic) [▶ 37].

Sample: access via the generic function block FB_MDP_ReadElement

Enumeration definition

```
//** = simply adjust these lines if modifying code for own purposes

// central definition of state machine states
// (supports easy program modification)
{attribute 'qualified_only'}
TYPE E_State :
(
    Idle,                     // idle state
    ReadFanSpeedInit,         //** initiate reading fan speed
    ReadFanSpeedProcess       //** process reading fan speed
);
END_TYPE
```

```
PROGRAM MAIN
VAR
    // internal use
    sAmsNetId           : STRING := '';        //** ADS Net ID (local = '')
    eState              : E_State;             // Enum with index for state machine
    bStart              : BOOL := TRUE;        // flag to trigger restart of statemachine
    nData               : UINT;                // data storage for unsigned integer
    stMDP_Addr          : ST_MDP_Addr;         // structure will include all address parameters
    nModuleIndex        : USINT := 0;          //** Fan index (no. of fan)

    // FB instances
    fbReadMDPElement    : FB_MDP_ReadElement;  // instance of FB for reading MDP element

    // results of execution
    bError              : BOOL;                // error flag (indicator: error occured)
    nErrID              : UDINT;               // last error ID
    aFanSpeed           : ARRAY[0..1] OF UINT; //** buffer for speed of fans
END_VAR
```

Program code

```
// For an easy re-use of the following code for own purposes, parts of this sample program use
// "general" data names (and copy the results in specific variables after processing the code).
// Remark: Error 16#EC800002 means module type not supported (IPC does not provide this type of
information, e.g. does not have fans)

CASE eState OF
    E_State.Idle:
        IF bStart THEN
            bStart := FALSE;
            eState := E_State.ReadFanSpeedInit;    //** initiate first state
        END_IF

    E_State.ReadFanSpeedInit:                  //**
        stMDP_Addr.nArea := INT_TO_BYTE(eMDP_Area_ConfigArea); //** set area address to "Config
Area"
        stMDP_Addr.nTableId := 1;              //** table ID in module for "Fan properties"
        stMDP_Addr.nSubIdx := 1;               //** subindex in table ID for "Fan speed"

        fbReadMDPElement(
            bExecute := TRUE,                  // Flag: trigger execution of FB
            eModuleType := eMDP_ModT_Fan,      //** desired module type = Fan
            stMDP_Addr := stMDP_Addr,          // MDP address structure. Dynamic module ID added
internally.
            iModIdx := nModuleIndex,           //** instance of desired module type (0 = first
instance)
            pDstBuf := ADR(nData),             // buffer for storing data
            cbDstBufLen := SIZEOF(nData),      // length of buffer
            sAmsNetId := sAmsNetId,            // AMS Net ID
            );                                 //** Note: fbReadMDPElement.tTimeOut must be > cycle
time!


        eState := E_State.ReadFanSpeedProcess;//** next state: process FB

    E_State.ReadFanSpeedProcess:               //** process FB: request fan data
        fbReadMDPElement(bExecute := FALSE);   // Flag: Get execution state of FB
                                               //** Note: fbReadMDPElement.tTimeOut must be > cycle
time!

        IF NOT fbReadMDPElement.bBusy THEN     // FB executed?
            IF fbReadMDPElement.bError THEN    // Error?
                bError := TRUE;                // set error flag
                nErrID := fbReadMDPElement.nErrID; // store error id (16#ECA60105 = BIOS or HW does
                                               // not support this data (here: mainboard data))
                eState := E_State.Idle;        // finish state machine
            ELSE                               // set parameters for next steps
                bError := FALSE;               // turn off error flag
                aFanSpeed[nModuleIndex] := nData; //** store fan speed in dedicated array
                IF nModuleIndex = 0 THEN       //** Current fan = fan 1?
                    nModuleIndex := 1;         //** Read fan 2 (= second module instance) in next
loop
                ELSE                           //**
                    nModuleIndex := 0;         //** Read fan 1 (= first module instance) in next loop
                END_IF                         //**
                eState := E_State.ReadFanSpeedInit; //** next state
            END_IF
        END_IF

END_CASE
```

8.4 Reading IPC serial numbers

This sample illustrates access to the serial number of the IPCs and the serial number of the IPC's mainboard.

- The serial number of the mainboard can be read via a subindex in module Mainboard in the Configuration Area of the IPC diagnostics. The general function block FB_MDP_ReadElement [▶ 14] is used for this purpose.
- The serial number of the IPC can be read via index 0xF9F0 in the Device Area of the IPC diagnostics. The general function block FB_MDP_ReadIndex [▶ 13] is used for this purpose.

Sample: querying the serial number of a Beckhoff IPC

Enumeration definition

```
//** = simply adjust these lines if modifying code for own purposes

// central definition of state machine states
// (supports easy program modification)
{attribute 'qualified_only'}
TYPE E_State :
(
    Idle,                          // idle state
    ReadSnoMainboardInit,          //** initiate reading serial number of mainboard
    ReadSnoMainboardProcess,       //** process reading serial number of mainboard
    ReadSnoIPCInit,                //** initiate reading serial number of IPC
    ReadSnoIPCProcess              //** process reading serial number of IPC
);
END_TYPE
```

Variable Declaration

```
PROGRAM MAIN
VAR
    // internal use
    sAmsNetId                : STRING := ''; //** ADS Net ID (local = '')
    eState                   : E_State;      // Enum with index for state machine
    bStart                   : BOOL := TRUE; // flag to trigger restart of statemachine
    sData                    : STRING;       // data storage for string variable
    stMDP_Addr               : ST_MDP_Addr;  // structure which will include all address parameters

    // FB instances
    fbReadMDPElement         : FB_MDP_ReadElement;  // instance of FB for reading MDP element
    fbReadMDPIndex           : FB_MDP_ReadIndex;    // instance of FB for reading MDP index

    // results of execution
    bError                   : BOOL;         // error flag (indicator: error occured)
    nErrID                   : UDINT;        // last error ID
    sSerialNoMainboard       : STRING;       //** buffer for serial number of mainboard
    sSerialNoIPC             : STRING;       //** buffer for serial number of IPC
END_VAR
```

Program code

```
// For an easy re-use of the following code for own purposes, parts of this sample program use
// "general" data names (and copy the results in specific variables after processing the code).

CASE eState OF
     E_State.Idle:
         IF bStart THEN
           bStart := FALSE;
            eState := E_State.ReadSnoMainboardInit;  //** initiate first state
         END_IF

    //
** read serial number of mainboard *********************************************************************

    E_State.ReadSnoMainboardInit:                  //** trigger FB: request mainboard serial number
        sData                := '';                // clear data buffer
        sSerialNoMainboard   := '';                //** clear buffer for serial number of mainboard
        stMDP_Addr.nArea     := INT_TO_BYTE(eMDP_Area_ConfigArea);  //
** set area address to "Config Area"
        stMDP_Addr.nTableId := 1;                  //** table ID in index for "mainboard information"
        stMDP_Addr.nSubIdx   := 2;                 //
** subindex in table ID for "serial number"
```

```
        fbReadMDPElement(
            bExecute     := TRUE,                // Flag: trigger execution of FB
            eModuleType  := eMDP_ModT_Mainboard, //
** desired module type / index = Mainboard
            stMDP_Addr   := stMDP_Addr,          // MDP address structure. Dynamic module ID will be
added internally.
            iModIdx      := 0,                   //
** Instance of desired module type (default: 0 = first instance)
            pDstBuf      := ADR(sData),          // buffer for storing data
            cbDstBufLen  := SIZEOF(sData),       // length of buffer
            sAmsNetId    := sAmsNetId,           // AMS Net ID
            );

        eState := E_State.ReadSnoMainboardProcess; //** next state: process FB

    E_State.ReadSnoMainboardProcess:             //** process FB: request mainboard serial number
        fbReadMDPElement(bExecute := FALSE);     // Flag: Get execution state of FB

        IF NOT fbReadMDPElement.bBusy THEN       // FB executed?
            IF fbReadMDPElement.bError THEN      // Error?
                bError := TRUE;                  // set error flag
                nErrID := fbReadMDPElement.nErrID; // store error id (16#ECA60105 = BIOS or HW does
                                                 // not support this data (here: mainboard data))
                eState := E_State.Idle;          // finish state machine
            ELSE                                 // set parameters for next steps
                bError := FALSE;                 // turn off error flag
                sSerialNoMainboard := sData;     //
** store serial number of mainboard in dedicated variable
                eState := E_State.ReadSnoIPCInit; //** next state
            END_IF
        END_IF

    //
** read serial number of IPC **************************************************************
    E_State.ReadSnoIPCInit:                      //
** trigger FB: request single index in MDP Device Area, IPC serial number
        sData            := '';                  // clear data buffer
        sSerialNoIPC     := '';                  //** clear buffer for serial number of IPC

        fbReadMDPIndex(
            bExecute     := TRUE,                // Flag: trigger execution of FB
            nIndex       := 16#F9F0,             //** index: read serial number IPC (-
> see docu 'MDP device area')
            nSubIndex    := 0,                   //
** first subdindex (there is only one available for index 16#F9F0)
            pDstBuf      := ADR(sData),          // buffer for storing serial number
            cbDstBufLen  := SIZEOF(sData),       // length of buffer
            sAmsNetId    := sAmsNetId,           // AMS Net ID
            );

        eState := E_State.ReadSnoIPCProcess;     //** next state: process FB

    E_State.ReadSnoIPCProcess:                   //
** process FB:: request single index in MDP Device Area, IPC serial number

        fbReadMDPIndex(bExecute := FALSE);       // flag: Get execution state of FB

        IF NOT fbReadMDPIndex.bBusy THEN         // FB executed?
            IF fbReadMDPIndex.bError THEN        // error?
                bError := TRUE;                  // set error flag
                nErrID := fbReadMDPIndex.nErrID; // store error id (16#ECA60105 = BIOS or HW does
                                                 // not support this data (here: IPC serial number))
                eState := E_State.Idle;          // finish state machine
            ELSE                                 // set parameters for next steps
                bError := FALSE;                 // turn off error flag
                sSerialNoIPC := sData;           //** store serial number of mainboard
                eState := E_State.Idle;          //
** set here next state if expanding the state machine
            END_IF
        END_IF

END_CASE
```

Returning of the mainboard serial number instead of the IPC serial number

In older BIOS version (before Q4/2013) the serial number was not stored in the IPC BIOS. In these cases the return value is the serial number of the IPC mainboard. With older Beckhoff Automation Device Driver versions, the return value is also the serial number of the IPC mainboard. The serial number of the IPC mainboard can always be read via the mainboard module

8.5 Setting the IP address

This sample illustrates write access to IPC diagnostics data via general function blocks. In the same way all other elements of the IPC diagnostics modules can be accessed.

Active network connection

Changing these settings requires an active network connection for the selected Ethernet/EtherCAT adapter. Without an active network connection no parameters can be (pre-)set.

Sample: setting the IP address of a Beckhoff IPC

Variable Declaration

```
PROGRAM MAIN
// First DHCP is set off and then the given new IP address is set.
// The program code is executed only one time. To restart the program set bStart TRUE again.
VAR
    bStart     : BOOL := TRUE;
    nState     : INT := 100;
    fbScan     : FB_MDP_ScanModules;
    fbWrite    : FB_MDP_Write;
    stMDPAddr  : ST_MDP_Addr;
    bDHCP      : BOOL;
    sIP        : T_IPv4Addr := '174.18.3.154'; // the new ip address
    bError     : BOOL;
    nErrID     : UDINT;
END_VAR
```

Program code

```
CASE nState OF
100: // idle
    IF bStart THEN
        bStart := FALSE;
        nState := 00;
    END_IF

00: (* scan MDP module list for dyn.module id of NIC module *)
    fbScan(
        bExecute    := TRUE,
        nModuleType := eMDP_ModT_NIC,
        iModIdx     := 0, (* index of NIC module / network port *)
        sAmsNetId   := ''
        );

    nState := 01;

01:
    fbScan( bExecute:= FALSE );

    IF NOT fbScan.bBusy THEN
        IF NOT fbScan.bError THEN
            stMDPAddr.nArea      := INT_TO_BYTE(eMDP_Area_ConfigArea);
            stMDPAddr.nModuleId  := fbScan.nDynModuleId;
            stMDPAddr.nTableId   := 1;
            nState               := 10;
        ELSE
            bError               := TRUE;
            nErrID               := fbScan.nErrID;
            nState               := 00;
        END_IF
    END_IF

10: // set DHCP off
    stMDPAddr.nSubIdx := 4; // DHCP
    bDHCP             := FALSE;

    fbWrite(
        bExecute      := TRUE,
        stMDP_DynAddr := stMDPAddr,
        pSrcBuf       := ADR(bDHCP),
        cbSrcBufLen   := SIZEOF(bDHCP),
        sAmsNetId     := ''
         );

    nState:= 11;
```

```
11:
    fbWrite( bExecute:= FALSE );
    IF NOT fbWrite.bBusy THEN
        IF NOT fbWrite.bError THEN
            nState      := 20;
        ELSE
            bError      := TRUE;
            nErrID      := fbWrite.nErrID;
            nState      := 10;
        END_IF
    END_IF

20: // set new IP address
    stMDPAddr.nSubIdx := 2; // IP address
    fbWrite(
        bExecute      := TRUE,
        stMDP_DynAddr := stMDPAddr,
        pSrcBuf       := ADR(sIP),
        cbSrcBufLen   := LEN(sIP),
        sAmsNetId     := ''
    );

    nState := 21;

21:
    fbWrite( bExecute:= FALSE );
    IF NOT fbWrite.bBusy THEN
        IF NOT fbWrite.bError THEN
            nState      := 100; (* NIC settings executed *)
        ELSE
            bError      := TRUE;
            nErrID      := fbWrite.nErrID;
            nState      := 20;
        END_IF
    END_IF
END_CASE
```

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