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# EpicsComModule
# TwinCAT 3 integration into EPICS

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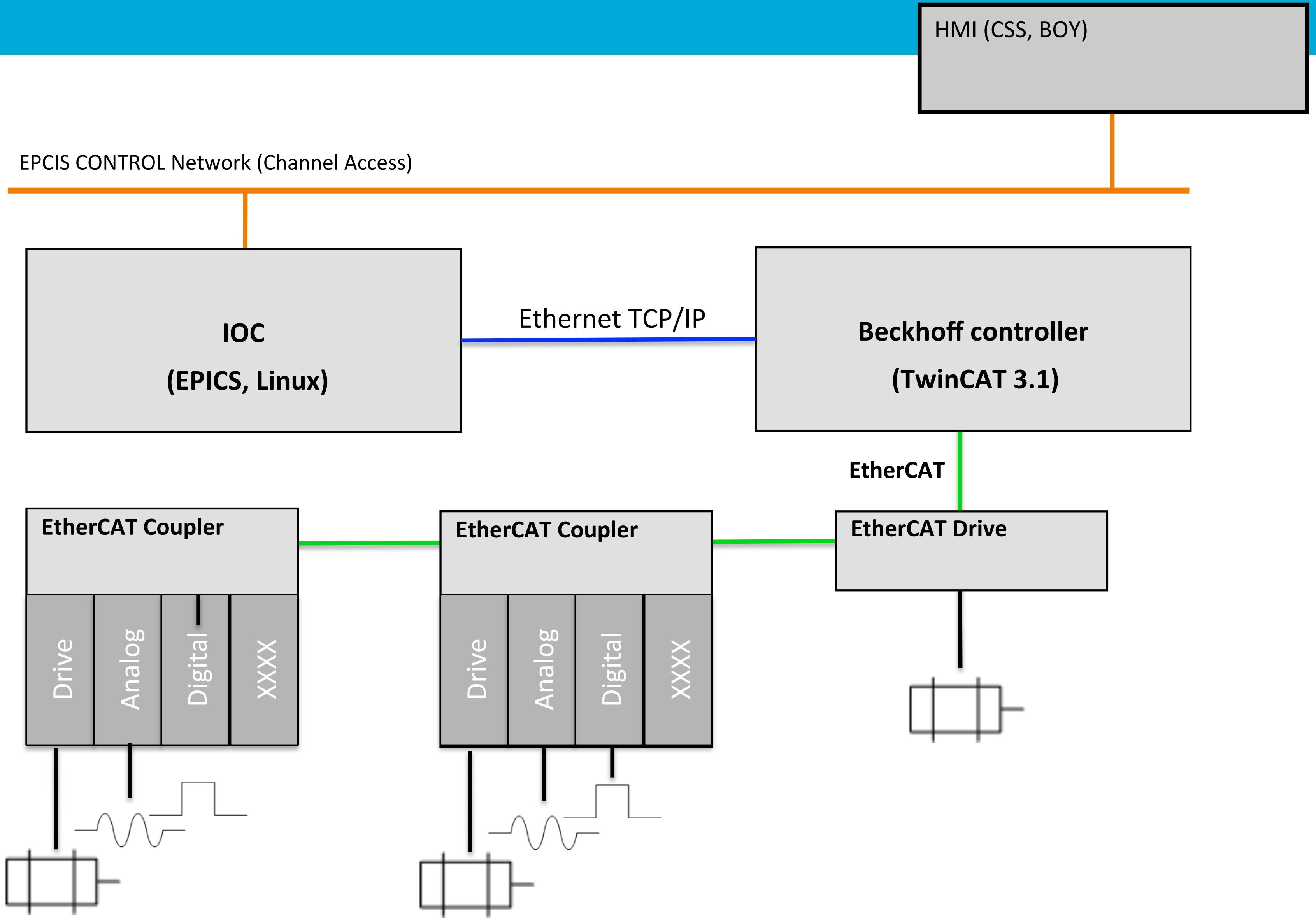
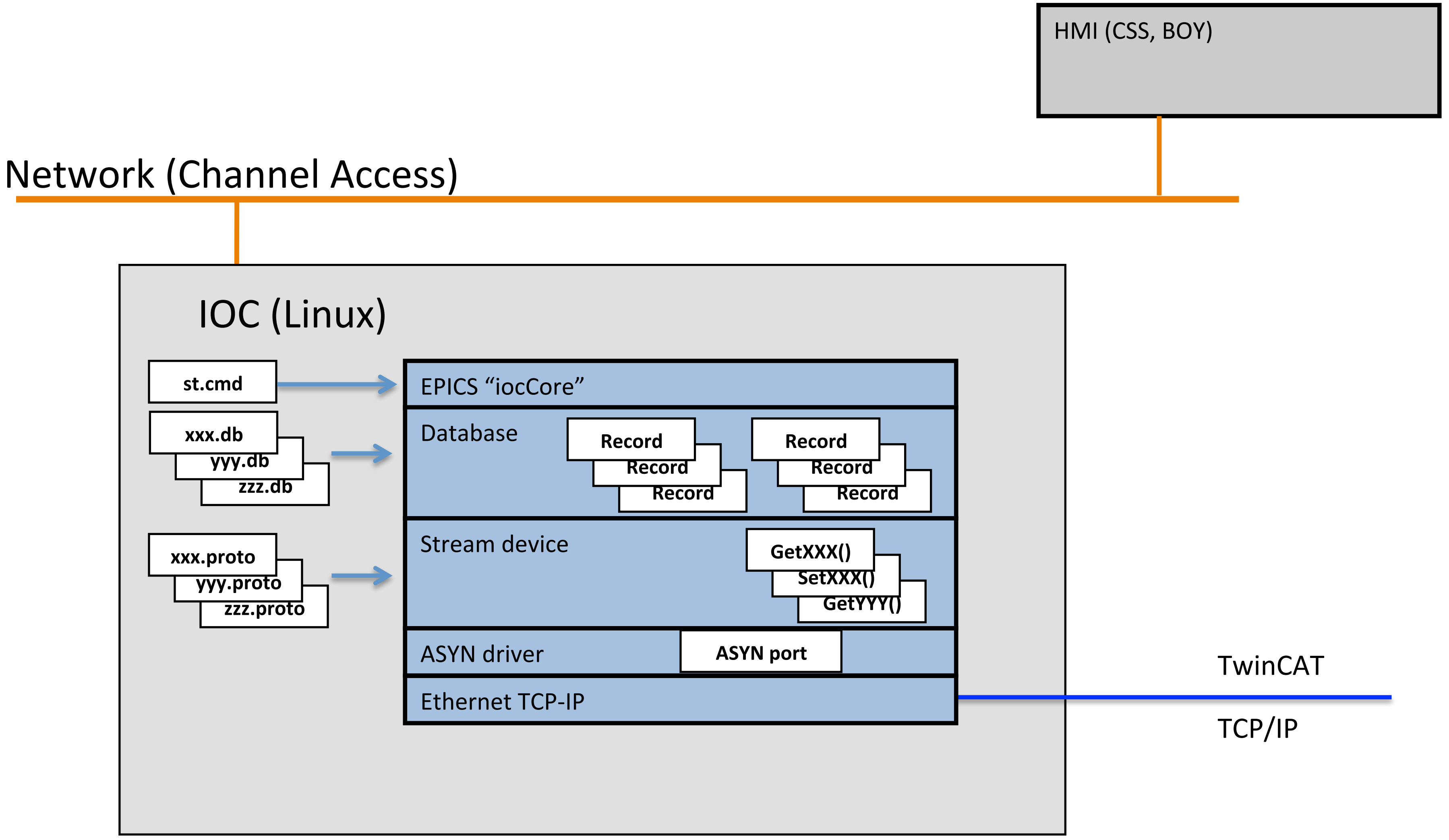
# Overview

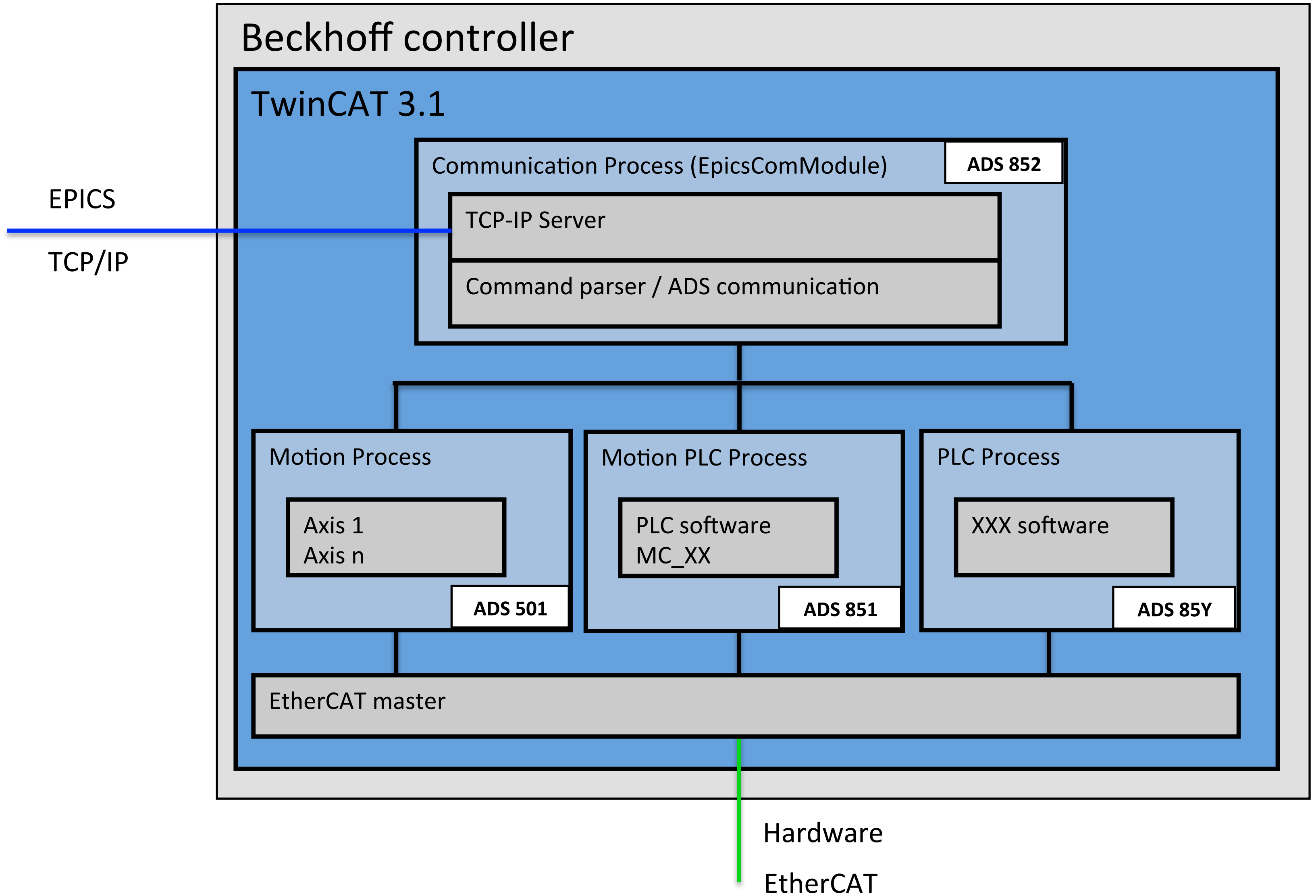


HMI (CSS, BOY)
EPCIS CONTROL Network (Channel Access)
IOC
(EPICS, Linux)
Ethernet TCP/IP
Beckhoff controller
(TwinCAT 3.1)
EtherCAT
EtherCAT Coupler
Drive
Analog
Digital
XXXX
EtherCAT Coupler
Drive
Analog
Digital
XXXX
EtherCAT Drive

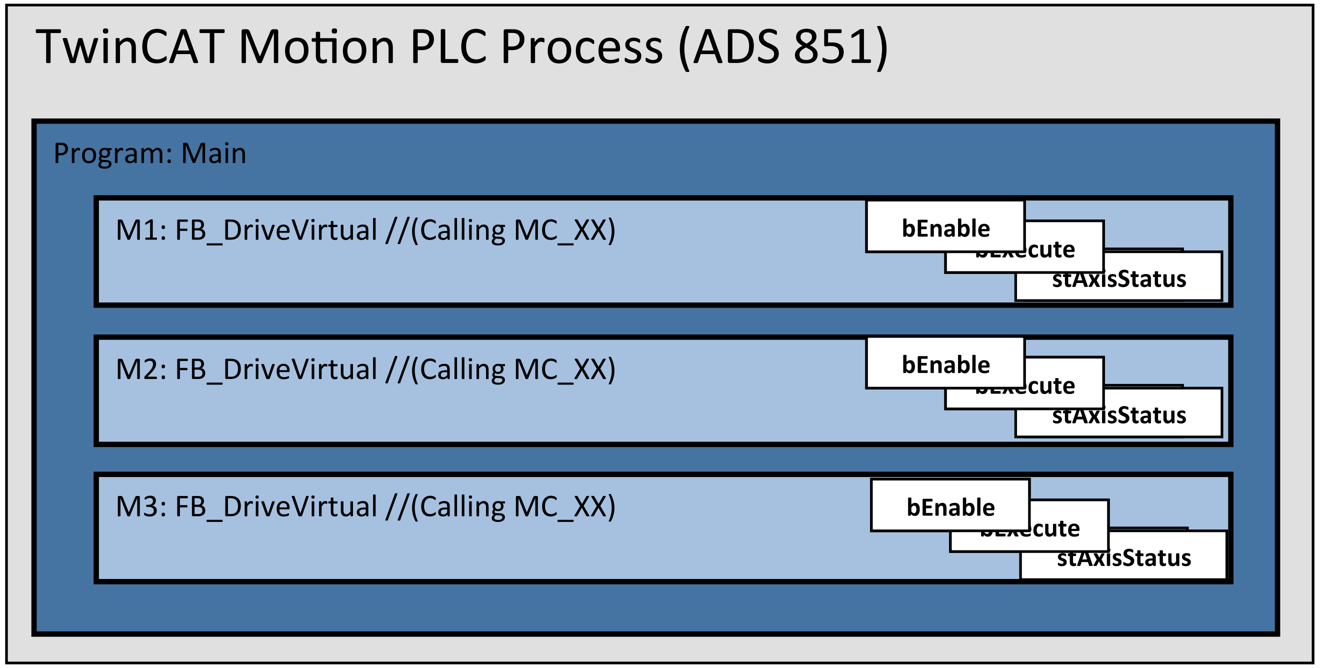
## EPICS


HMI (CSS, BOY)
Network (Channel Access)
IOC (Linux)
st.cmd
xxx.db
yyy.db
zzz.db
xxx.proto
yyy.proto
zzz.proto
EPICS “iocCore”
Database
Record
Record
Record
Record
Record
Record
Stream device
GetXXX()
SetXXX()
GetYYY()
ASYN driver
ASYN port
Ethernet TCP-IP
TwinCAT
TCP/IP

# TwinCAT controller



## Motion Process (FB_DriveVirtual = control one axis)


TwinCAT Motion PLC Process (ADS 851)
Program: Main
M1: FB_DriveVirtual //(Calling MC_XX)
bEnable
bExecute
stAxisStatus
M2: FB_DriveVirtual //(Calling MC_XX)
bEnable
bExecute
stAxisStatus
M3: FB_DriveVirtual //(Calling MC_XX)
bEnable
bExecute
stAxisStatus

**FB_DriveVirtual supports:** Jog, constant speed, absolute position, relative position, homing, gear……….

## Protocol General

- Frame terminator = LF (linefeed = ascii 10)
- Commands separator = “;”
- An option may be supplied before each command separated with”/”
- Commands can be stacked

Example:

“**Option1#**Command1;Command2;**Option3#**Command 3;
”

## Protocol Write

Writing a value:

- “Symbolic name in PLC=value;”
- Acknowledgement:
  - “OK;” if successful
  - Error code if not successful

Example:

“Main.M1.fPosition=100; Main.M1.fVelocity=1000;
”

Will return: “OK;OK;
”

## Protocol Read

Reading a value:

- "Symbolic name in PLC?;"
- Acknowledgement:
  - Value if successful
  - Error code if not successful

Example:

"Main.M1.fPosition?; Main.M1.fVelocity?;
"

Will return: "100;1000;
"

## Protocol Option ADSPORT

ADSPORT:

- Sets ADS-port temporary for the command
- ADS-Port is default set to 851 which normally is the first PLC

Example (accessing two different modules in TwinCAT):

“ADSPORT=851/Main.M1.fPosition=100;ADSPORT=852/Main.iCounter?;
”

## Static Command: ADR

.ADR.:

- Allows read and write access to absolute addresses:
  - Write: “.ADR.IndexGrp,IndexOffset,Size,Type=value;”
  - Read: “.ADR.IndexGrp,IndexOffset,Size,Type?;”
- Read absolute address for symbolic variables:
  - “.ADR.symbolicvarname?;”

***Example: Write and read soft limit maximum position for Axis 1 (8 bytes, type 5):***

**Command:** *“ADSPORT=501/.ADR.16#5001,16#E,8,5=100;”* **Response:** *“OK;”*

**Command:** *“ADSPORT=501/.ADR.16#5001,16#E,8,5?;”* **Response:** *“100.0;”*

***Example: Read absolute address of symbolic variable:***

**Command**: *“.ADR.Main.M1.bEnable?;”* **Answer**:*“16#4040,16#7DE01,1,33;”*

## Static Command: THIS

.THIS.:

- Allows read and write access settings for the current connection:
  - Write: “.THIS.variablename=value;”
  - Read: “.THIS.variablename?;”

***Example: Write and read default ADS-port for current connection:***

| | |
|---|---|
| ***Command:*** *“ADSPORT=852/.THIS.stSettings.nADSPort=852;”* | ***Response:*** *“OK;”* |
| ***Command:*** *“ADSPORT=852/.THIS.stSettings.nADSPort?;”* | ***Response:*** *“852;”* |

***Example: Setting to also read and return data on write commands:***

| | |
|---|---|
| ***Command:*** *“ADSPORT=852/.THIS.stSettings.bReturnData=1;”* | ***Response:*** *“1;”* |

*NOTE: The “.THIS.” command is only available for ADS-port of the EpicsComModule (852 in the examples above)*

## Supported native data types

| | TwinCat data type | Size [bits] | Array | Comment |
|---|---|---|---|---|
| 1 | ADST_BIT | 1 | Yes | Bit |
| 2 | ADST_SINT8 | 8 | Yes | Short Integer. |
| 3 | ADST_UINT8 | 8 | Yes | Byte |
| 4 | ADST_INT16 | 16 | Yes | Integer |
| 5 | ADST_UINT16 | 16 | Yes | Unsigned Integer |
| 6 | ADST_INT32 | 32 | Yes | Double Integer |
| 7 | ADST_UINT32 | 32 | Yes | Unsigned double Integer |
| 8 | ADST_INT64 | 64 | Yes | Long Integer |
| 9 | ADST_UINT64 | 64 | Yes | Unsigned Long Integer |
| 10 | ADST_REAL32 | 32 | Yes | Real |
| 11 | ADST_REAL64 | 64 | Yes | Double |
| 12 | ADST_STRING | 8*length | No | String (arrays of strings not supported) |

# Supported custom data type: DUT_AxisStatus

**DUT_AxisStatus:**
The structure DUT_AxisStatus includes the most important information available for one axis and can be **read** with one single command.

**Restrictions:**
Only implemented for reading purpose.
Arrays of this structure is not supported (since EPICS don't have support for arrays of structures).

**Example:**
"Main.M1.stAxisStatus?;"

Will return:
"Main.M1.stAxisStatus= 1 ,0, 1, 2, …….;"

```
DUT_AxisStatus_v0_01:
                bEnable: BOOL;
                bReset: BOOL;
                bExecute: BOOL;
                nCommand: UINT;
                nCmdData: UINT;
                fVelocity: LREAL;
                fPosition: LREAL;
                fAcceleration: LREAL;
                fDeceleration: LREAL;
                bJogFwd: BOOL;
                bJogBwd: BOOL;
                bLimitFwd: BOOL;
                bLimitBwd: BOOL;
                fOverride: LREAL:=100;
                bHomeSensor: BOOL;
                bEnabled: BOOL;
                bError: BOOL;
                nErrorId: UDINT;
                fActVelocity: LREAL;
                fActPosition: LREAL;
                fActDiff: LREAL;
                bHomed:BOOL;
                bBusy:BOOL;
```