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N2 control through the embedded fieldbus interface (EFB)

Contents of this chapter

The chapter describes N2 control through the embedded fieldbus interface (EFB): supported functionality, services and objects as well as how to configure the N2 with parameters.
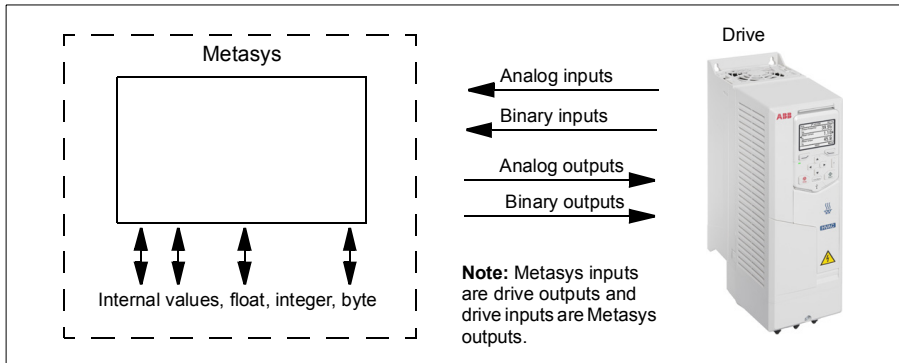
N2 overview

The N2 fieldbus connection to the ACH580 drives is based on an industry standard RS-485 physical interface. The N2 fieldbus protocol is a master-slave type, serial communication protocol, used by the Johnson Controls Metasys® system. In the Metasys architecture the N2 fieldbus connects object interfaces and remote controllers to network control units (NCUs).

The N2 fieldbus can also be used to connect ACH580 drives to the Metasys Companion product line.

This section describes the use of the N2 fieldbus with the ACH580 drive's connection and does not describe the protocol in detail.

■ Supported features

In the N2 fieldbus protocol the ACH580 drive appears as a "virtual object".

A virtual object is made up of:

*   analog inputs
*   binary inputs
*   analog outputs
*   binary outputs
*   internal values for floating point, integer, and byte values.

The ACH580 drive does not support N2 fieldbus communication "internal values".

All of the analog and binary I/O objects are listed below, starting with N2 analog input objects.

Analog input - the analog input objects support the following features:

*   analog input actual value in engineering units
*   low alarm limit
*   low warning limit
*   high warning limit
*   high alarm limit
*   differential value for the hysteresis of the alarms and warnings
*   change of state (COS) enabled
*   alarm enabled
*   warning enabled
*   override value is received, but there is no action taken.

Binary input - the binary input objects support the following features:

- binary input actual value
- normal / alarm state specification
- alarm enabled
- change of state (COS) enabled
- override value is received, but there is no action taken.

Analog output - the analog output objects support the following features:
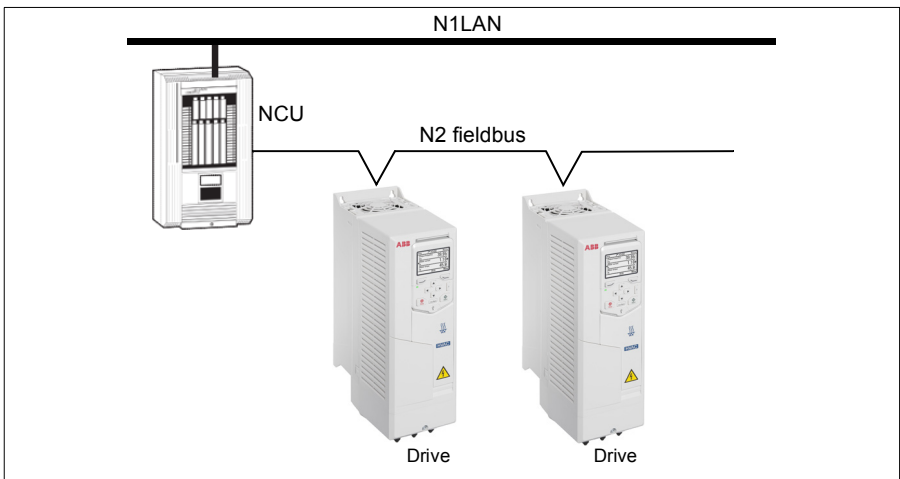
- analog output value in engineering units
- override value is used to change the analog output value. It is not possible to return to the previous value by removing the override. The override feature is used only to change the value.

Binary output - the binary output objects support the following features:
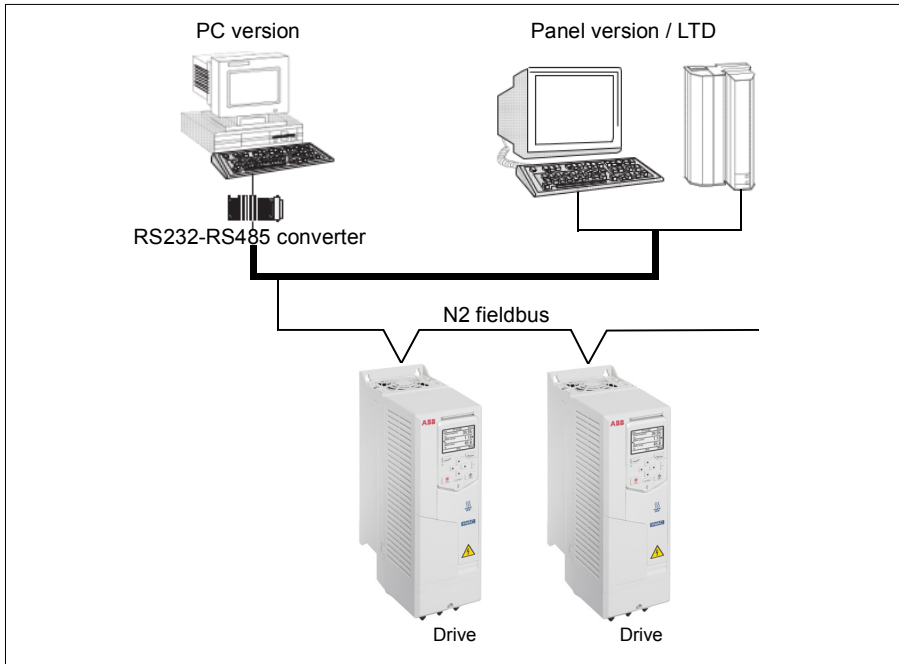
- binary output value
- override value is used to change the binary output value. It is not possible to return to the previous value by removing the override. The override feature is used only to change the value.

■ Metasys integration

The following diagram shows the drives' integration to the Johnson Controls Metasys system.

The following diagram shows the drive's integration to the Johnson Controls Metasys Companion system.

On the N2 fieldbus each ACH580 drive can be accessed by the full complement of Metasys FMS features, including change-of-state (COS) monitoring, alarm notification, scheduling, trend, and totalization.

On one N2 fieldbus segment there can be up to 32 nodes while integrating ACH580 drives with Johnson Controls Metasys.
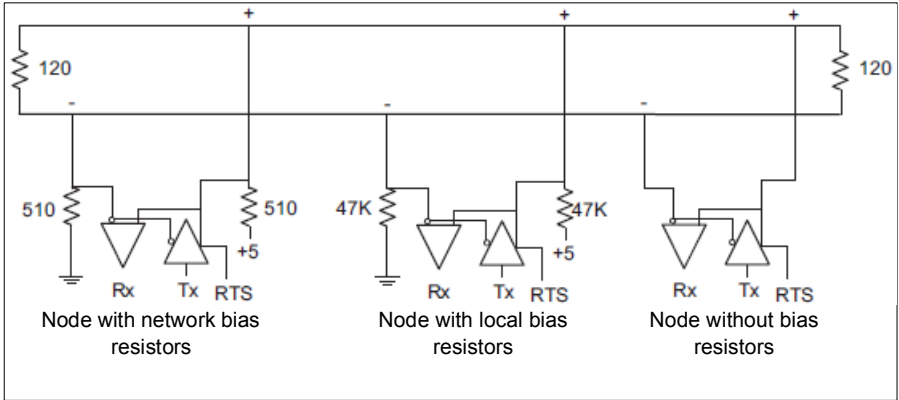
■ **Drive device type**

For the Metasys and Metasys Companion products, the device type for the ACH580 drive is VND.

Hardware installation

◼ Connecting devices to a N2 EIA-485 network

The figure shows three types of nodes connected on the EIA-485 network.

Node with network bias resistors   Node with local bias resistors   Node without bias resistors

◼ Connecting the drive to the building automation controller

For connecting the EFB terminal block X5 of the drive to the building automation controller via the EIA-485 network, see section *Connecting the drive to the fieldbus* on page *214*.

N2 analog input objects

The following table lists the N2 analog input objects defined for the ACH580 drive.

N2 analog inputs						
No	Object	Drive parameter	Scale factor	Units	Range	Notes
AI1	OUTPUT FREQUENCY	*01.06 Output frequency*	100	Hz	0…250	
AI2	RATED SPEED	*01.62 Abs motor speed %*	100	%	0…100	
AI3	SPEED	*01.01 Motor speed used*	100	rpm	0…9999	
AI4	CURRENT	*01.07 Motor current*	100	A	0…9999	
AI5	TORQUE	*01.10 Motor torque*	100	%	-200…200	
AI6	POWER	*01.17 Motor shaft power*	10	kW	0…9999	
AI7	DRIVE TEMPERATURE	*05.11 Inverter temperature*	10	%	-40…160	

No	Object	Drive parameter	Scale factor	Units	Range	Notes
AI8	KILOWATT HOURS	*01.58 Cumulative inverter energy (resettable)*	10	kW	0…65535	
AI9	MEGAWATT HOURS	Derived value	10000	MWh	0…65535	Parameter *01.54 Cumulative inverter energy* / 1000
AI10	RUN TIME	*05.03 Hours run*	10	h	0…65535	
A11	DC BUS VOLTAGE	*01.11 DC voltage*	100	V	0…999	
AI12	OUTPUT VOLTAGE	*01.13 Output voltage*	1	V	0…999	
AI13	PRC PID FEEDBACK	*40.97 Process PID feedback %*	100	%	0…100	
AI14	PRC PID DEVIATION	*40.99 Process PID deviation %*	100	%	0…100	
AI15	EXT PID FEEDBACK	Derived value	10	%	0…100	= *71.02 Feedback act value* * 1000 / *71.14 Setpoint scaling*
AI16	EXT PID DEVIATION	Derived value	10	%	0…100	= *71.04 Deviation act value* * 1000 / *71.14 Setpoint scaling*
AI17	LAST FAULT	Derived value	1		fault code	Most recent fault
AI18	PREV FAULT	Derived value	1		fault code	Second most recent fault
AI19	OLDEST FAULT	Derived value	1		fault code	Third most recent fault
AI20	AI 1 ACTUAL	*12.101 AI1 percent value*	100	%	0…100	
AI21	AI 2 ACTUAL	*12.102 AI2 percent value*	100	%	0…100	
AI22	AO 1 ACTUAL	*13.11 AO1 actual value*	1000	mA	0…20	
AI23	AO 2 ACTUAL	*13.21 AO2 actual value*	1000	mA	0…20	
AI24	MOTOR TEMP	Derived value	1	°C	0…200	Value is derived from *35.01*, *35.02* and *35.03*: • If *35.11* and *35.21* are both non-zero, the temperature is the maximum value of *35.02* and *35.03*. • If only *35.11* is non-zero, the temperature is value of *35.02*. • If only *35.21* is non-zero, the temperature is value of *35.03*. • If both *35.11* and *35.21* are zero, the value is as *35.01*.

N2 analog inputs

N2 binary input objects

The following table lists the N2 binary input objects defined for the ACH580 drive.

No	Object	Drive parameter	Range
— **N2 binary inputs**			
BI1	STOP/RUN	Status Word, bit 2	0 = Drive received start command 1 = Drive has not received start command
BI2	FORWARD/REVERSE	Status Word, bit 11	0 = Forward, 1 = Reverse
BI3	FAULT STATUS	Status Word, bit 15	0 = OK, 1 = Drive fault
BI4	RELAY 1 STATUS	*10.21 RO status*, bit 0	0 = Off, 1 = On
BI5	RELAY 2 STATUS	*10.21 RO status*, bit 1	0 = Off, 1 = On
BI6	RELAY 3 STATUS	*10.21 RO status*, bit 2	0 = Off, 1 = On
BI7	RELAY 4 STATUS	*15.04 RO/DO status*, bit 0	0 = Off, 1 = On
BI8	RELAY 5 STATUS	*15.04 RO/DO status*, bit 1	0 = Off, 1 = On
BI9	DIGITAL OUTPUT1 STATUS	*15.04 RO/DO status*, bit 2	0 = Off, 1 = On
BI10	INPUT 1 STATUS	*10.02 DI delayed status*, bit 0	0 = Off, 1 = On
BI11	INPUT 2 STATUS	*10.02 DI delayed status*, bit 1	0 = Off, 1 = On
BI12	INPUT 3 STATUS	*10.02 DI delayed status*, bit 2	0 = Off, 1 = On
BI13	INPUT 4 STATUS	*10.02 DI delayed status*, bit 3	0 = Off, 1 = On
BI14	INPUT 5 STATUS	*10.02 DI delayed status*, bit 4	0 = Off, 1 = On
BI15	INPUT 6 STATUS	*10.02 DI delayed status*, bit 5	0 = Off, 1 = On
BI16	EXTERNAL 2 SELECT	DCU Status Word, bit 14	0 = EXT1 active, 1 = EXT2 active
BI17	HAND/AUTO	DCU Status Word, bit 12	0 = AUTO, 1 = HAND
BI18	ALARM	DCU Status Word, bit 16	0 = OK, 1 = Warning/alarm
BI20	DRIVE READY	DCU Status Word, bit 0	0 = Not ready, 1 = Ready
BI21	AT SETPOINT	DCU Status Word, bit 7	0 = No, 1 = At setpoint
BI22	RUN ENABLED	DCU Status Word, bit 1	0 = Not enabled, 1 = Enabled
BI23	N2 LOCAL MODE	DCU Status Word, bit 13	0 = Auto, 1 = N2 local
BI24	N2 CONTROL SRC	DCU Status Word, bit 26	0 = No, 1 = Yes
BI25	N2 REF1 SRC	DCU Status Word, bit 27	0 = No, 1 = Yes

N2 binary inputs			
No	**Object**	**Drive parameter**	**Range**
BI26	N2 REF2 SRC	DCU Status Word, bit 28	0 = No, 1 = Yes

N2 analog output objects

The following table lists the N2 analog output objects defined for the ACH580 drive.

N2 analog outputs						
No	**Object**	**Drive parameter**	**Scale factor**	**Units**	**Range**	**Notes**
AO1	REFERENCE 1	Reference 1	10	%	0…100	
AO2	REFERENCE 2	Reference 2	10	%	0…100	
AO3	ACCEL TIME 1	No direct mapping	1000	s	0.1…1800	If parameter *99.04 Motor control mode* is set • to vector mode (*99.04* = 0), map to *23.12 Acceleration time 1*. • to scalar mode (*99.04* = 1), map to *28.72 Freq acceleration time 1*.
AO4	DECEL TIME 1	No direct mapping	1000	s	0.1…1800	If parameter *99.04 Motor control mode* is set • to vector mode (*99.04* = 0), map to *23.13 Deceleration time 1*. • to scalar mode (*99.04* = 1), map to *28.73 Freq deceleration time 1*.
AO5	CURRENT LIMIT	*30.17 Maximum current*	100	A	$0…1.3*I_{2N}$	
AO6	PID1-CONT GAIN	*40.32 Set 1 gain*	100	%	0.1…100	
AO7	PID1-CONT I-TIME	*40.33 Set 1 integration time*	10	s	0.1…600	
AO8	PID1-CONT D-TIME	*40.34 Set 1 derivation time*	10	s	0…10	
AO9	PID1-CONT D FILTER	*40.35 Set 1 derivation filter time*	10	s	0…10	
AO10	PID2-CONT GAIN	*41.32 Set 2 gain*	100	%	0.1…100	
AO11	PID2-CONT I-TIME	*41.33 Set 2 integration time*	10	s	0.1…600	
AO12	PID2-CONT D-TIME	*41.34 Set 2 derivation time*	1000	s	0…10	
AO13	PID2-CONT D FILTER	*41.35 Set 2 derivation filter time*	10	s	0…10	
AO14	COMMAND AO 1	*13.91 AO1 data storage*	10	%	0…100	
AO15	COMMAND AO 2	*13.92 AO2 data storage*	10	%	0…100	

N2 analog outputs						
No	Object	Drive parameter	Scale factor	Units	Range	Notes
AO16	EXT PID SETPOINT	*71.21 Internal setpoint 1*	100	%	0…100	
AO17	SPD OUT MIN	Derived value	10	%	0…200	Writing: • scalar mode: *30.13 Minimum frequency* = AO17 * *99.08 Motor nominal frequency* • vector mode: *30.11 Minimum speed* = AO17 * *99.09 Motor nominal speed*. Reading: • scalar mode: *99.08 Motor nominal frequency* / *30.13 Minimum frequency* • vector mode: *99.09 Motor nominal speed* / *30.11 Minimum speed*.
AO18	SPD OUT MAX	Derived value	10	%	0…200	Writing: • scalar mode: *30.14 Maximum frequency* =AO17 * *99.08 Motor nominal frequency* • vector mode: *30.12 Maximum speed* = AO17 * *99.09 Motor nominal speed*. Reading: • scalar mode: *99.08 Motor nominal frequency* / *30.13 Minimum frequency* • vector mode: *99.09 Motor nominal speed*/*30.11 Minimum speed*.
AO19	MAILBOX PARAMETER		1		0…65535	Mailbox feature is not supported
AO20	MAILBOX DATA		1		0…65535	Mailbox feature is not supported

N2 binary output objects

The following table lists the N2 binary output objects defined for the ACH580 drive.

N2 binary outputs				
No	Object	Drive parameter	Range	Notes
BO1	STOP/START	DCU Control Word, bit 0 and bit 1	0 = Stop, 1 = Start to Speed	Stop: set bit 0, clear bit 1 Start: set bit 1, clear bit 0

No	Object	Drive parameter	Range	Notes
colspan5 **N2 binary outputs**				

No	Object	Drive parameter	Range	Notes
BO2	FORWARD/REVERSE	DCU Control Word, bit 12	0 = Forward, 1 = Reverse	
BO3	PANEL LOCK	Derived	0 = Open, 1 = Locked	Derived from 96.03 Access level status, bit 14 parameter lock
BO4	RUN ENABLE	Derived value	0 = Enable, 1 = Disable	Invert DCU control word bit 6, RUN_DISABLE
BO5	REF1/REF2 SELECT	DCU Control Word, bit 5, EXT	0 = Ref1, 1 = Ref2	
BO6	FAULT RESET	DCU Control Word, bit 4, RESET	Change 0 -> 1 Resets	
BO7	COMMAND RO 1	*10.99 RO/DIO control word*, bit 0	0 = Off, 1 = On	
BO8	COMMAND RO 2	*10.99 RO/DIO control word*, bit 1	0 = Off, 1 = On	
BO9	COMMAND RO 3	*10.99 RO/DIO control word*, bit 2	0 = Off, 1 = On	
BO10	COMMAND RO 4	*10.99 RO/DIO control word*, bit 3	0 = Off, 1 = On	
BO11	COMMAND RO 5	*10.99 RO/DIO control word*, bit 4	0 = Off, 1 = On	
BO12	COMMAND RO 6	*10.99 RO/DIO control word*, bit 5	0 = Off, 1 = On	
BO13	RESET RUN TIME	Indirectly mapping	0 = N/A, 1 = On (Reset run rime, *05.03 Hours run*)	
BO14	RESET KWH COUNT	Indirectly mapping	0 = N/A, 1 = On (Reset kWh count *01.58 Cumulative inverter energy (resettable)*)	
BO15	PRC PID SELECT	*40.57 PID set1/set2 selection* (indirectly)	0 = SET1, 1 = SET2	If BO15 = 0, *40.57 PID set1/set2 selection* is set to PID Set1 (1). If BO15 = 1, *40.57 PID set1/set2 selection* is set to PID Set2 (2).
BO16	N2 LOCAL CTL [1]	DCU Control Word, bit 16	0 = Auto, 1 = N2	
BO17	N2 LOCAL REF [1]	DCU Control Word, bit 17	0 = Auto, 1 = N2	
BO18	SAVE PARAMETERS	*96.07 Parameter save manually* (indirectly)	0 = N/A, 1 = On (Save Parameters)	
BO19	READ MAILBOX		0 = No, 1 = Yes	Mailbox feature is not supported
BO20	WRITE MAILBOX		0 = No, 1 = Yes	Mailbox feature is not supported

N2 binary outputs				
No	Object	Drive parameter	Range	Notes

[1] N2 LOCAL CTL and N2 LOCAL REF have priority over drive input terminals. Use these binary outputs for temporary N2 control of the drive when COMM is not the selected control source Need to be verified.

DDL file for NCU

The listing below is the data definition language (DDL) file for ACH580 drives used with the network control units (NCU). It is useful when defining drive I/O objects to the network controller units. Below is the ACH580.DDL file listing.

```
********************************************************************************************

*                    ABB Drives,  ACH 580 Variable Frequency Drive

********************************************************************************************

CSMODEL "ACH_580","VND"


AITITLE "Analog_Inputs"
BITITLE "Binary_Inputs"
AOTITLE "Analog_Outputs"
BOTITLE "Binary_Outputs"
CSAI "AI1",N,N,"FREQ_ACT","Hz"
CSAI "AI2",N,N,"PCT_ACT","%"
CSAI "AI3",N,N,"SPEED","RPM"
CSAI "AI4",N,N,"CURRENT","A"
CSAI "AI5",N,N,"TORQUE","%"
CSAI "AI6",N,N,"POWER","kW"
CSAI "AI7",N,N,"DRV_TEMP_PCT","%"
CSAI "AI8",N,N,"ENERGY_k","kWh"
CSAI "AI9",N,N,"ENERGY_M","MWh"
CSAI "AI10",N,N,"RUN_TIME","H"
CSAI "AI11",N,N,"DC_VOLT","V"
CSAI "AI12",N,N,"VOLT_ACT","V"
CSAI "AI13",N,N,"PID1_ACT","%"
CSAI "AI14",N,N,"PID2_DEV","%"
CSAI "AI15",N,N,"PID2_ACT","%"
CSAI "AI16",N,N,"PID2_DEV","%"
```

```
CSAI "AI17",N,N,"LAST_FLT","Code"
CSAI "AI18",N,N,"PREV_FLT","Code"
CSAI "AI19",N,N,"1ST_FLT","Code"
CSAI "AI20",N,N,"AI_1_ACT","%"
CSAI "AI21",N,N,"AI_2_ACT","%"
CSAI "AI22",N,N,"AO_1_ACT","mA"
CSAI "AI23",N,N,"AO_2_ACT","mA"
CSAI "AI24",N,N,"MTR_TEMP","°C"
CSBI "BI1",N,N,"STOP/RUN","STOP","RUN"
CSBI "BI2",N,N,"FWD/REV","FWD","REV"
CSBI "BI3",N,N,"FAULT","OK","FLT"
CSBI "BI4",N,N,"RELAY_1","OFF","ON"
CSBI "BI5",N,N,"RELAY_2","OFF","ON"
CSBI "BI6",N,N,"RELAY_3","OFF","ON"
CSBI "BI7",N,N,"RELAY_4","OFF","ON"
CSBI "BI8",N,N,"RELAY_5","OFF","ON"
CSBI "BI9",N,N,"DO_1","OFF","ON"
CSBI "BI10",N,N,"INPUT_1","OFF","ON"
CSBI "BI11",N,N,"INPUT_2","OFF","ON"
CSBI "BI12",N,N,"INPUT_3","OFF","ON"
CSBI "BI13",N,N,"INPUT_4","OFF","ON"
CSBI "BI14",N,N,"INPUT_5","OFF","ON"
CSBI "BI15",N,N,"INPUT_6","OFF","ON"
CSBI "BI16",N,N,"EXT1/2","EXT1","EXT2"
CSBI "BI17",N,N,"HND/AUTO","AUTO","HAND"
CSBI "BI18",N,N,"ALARM","OFF","ON"
CSBI "BI20",N,N,"DRV_REDY","NO","YES"
CSBI "BI21",N,N,"AT_SETPT","NO","YES"
CSBI "BI22",N,N,"RUN_ENAB","NO","YES"
CSBI "BI23",N,N,"N2_LOC_M","AUTO","N2_L"
CSBI "BI24",N,N,"N2_CTRL","NO","YES"
CSBI "BI25",N,N,"N2_R1SRC","NO","YES"
CSBI "BI26",N,N,"N2_R2SRC","NO","YES"
CSAO "AO1",Y,Y,"REF_1","%"
```

CSAO "AO2",Y,Y,"REF_2","%"
CSAO "AO3",Y,Y,"ACCEL_1","s"
CSAO "AO4",Y,Y,"DECEL_1","s"
CSAO "AO5",Y,Y,"CURR_LIM","A"
CSAO "AO6",Y,Y,"PID1_GN","%"
CSAO "AO7",Y,Y,"PID1_I","s"
CSAO "AO8",Y,Y,"PID1_D","s"
CSAO "AO9",Y,Y,"PID1_FLT","s"
CSAO "AO10",Y,Y,PID2_GN","%"
CSAO "AO11",Y,Y,"PID2_I","s"
CSAO "AO12",Y,Y,"PID2_D","s"
CSAO "AO13",Y,Y,"PID2_FLT","s"
CSAO "AO14",Y,Y,"CMD_AO_1","%"
CSAO "AO15",Y,Y,"CMD_AO_2","%"
CSAO "AO16",Y,Y,"PI2_STPT","%"
CSAO "AO17",Y,Y,"MIN_SPD","%"
CSAO "AO18",Y,Y,"MAX_SPD","%"
CSAO "AO19",Y,Y,"MB_PARAM",""
CSAO "AO20",Y,Y,"MB_DATA",""
CSBO "BO1",Y,Y,"START","STOP","START"
CSBO "BO2",Y,Y,"REVERSE","FWD","REV"
CSBO "BO3",Y,Y,"PAN_LOCK","OPEN","LOCKED"
CSBO "BO4",Y,Y,"RUN_ENAB","ENABLE","DISABLE"
CSBO "BO5",Y,Y,"R1/2_SEL","EXT_1","EXT_2"
CSBO "BO6",Y,Y,"FLT_RSET","-","RESET"
CSBO "BO7",Y,Y,"CMD_RO_1","OFF","ON"
CSBO "BO8",Y,Y,"CMD_RO_2","OFF","ON"
CSBO "BO9",Y,Y,"CMD_RO_3","OFF","ON"
CSBO "BO10",Y,Y,"CMD_RO_4","OFF","ON"
CSBO "BO11",Y,Y,"CMD_RO_5","OFF","ON"
CSBO "BO12",Y,Y,"CMD_RO_6","OFF","ON"
CSBO "BO13",Y,Y,"RST_RTIM","OFF","RESET"
CSBO "BO14",Y,Y,"RST_KWH","OFF","RESET"
CSBO "BO15",Y,Y,"PID_SEL","SET1","SET2"

CSBO "BO16",Y,Y,"N2_LOC_C","AUTO","N2"
CSBO "BO17",Y,Y,"N2_LOC_R","AUTO","N2"
CSBO "BO18",Y,Y,"SAV_PRMS","OFF","SAVE"
CSBO "BO19",Y,Y,"READ_MB","NO","READ"
CSBO "BO20",Y,Y,"WRITE_MB","NO","WRITE"