


# FUNCTIONAL DESCRIPTION

## MOTFREQ01

### 1 Speed or Direction Variable Speed Motor

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## 1 General

MOTFREQ01 is a functional unit designed for the control of variable speed motors in different processes. It is based on the functionality of MOTCON and is designed primarily for use with AC frequency converters delivered by third-party vendors.

The functional unit is standardised to a high degree to simplify the work of designing presentation, dialog and control logic. The unit has many optional capabilities, which increase its operational flexibility. MOTFREQ01 normally performs its control function without help from other elements.

MOTFREQ01 is used in the control of variable speed motors from Operate<sup>IT</sup> Operator Station, control desks or control organs at the motor itself. The motor can be controlled from a master control function (e.g. group start, level regulation from level gauges etc).

## 2 Configuration

MOTFREQ01 like other functional units is built up of two parts:

- A Function Block, which is handled in the same way as other Function Blocks in the ABB Controller 800M range of products. Figure 3.1 illustrates the terminals on the function block.
- A section for operator functions, which consists of presentation and order functions. Data and parameters from the process are presented on an Operate<sup>IT</sup> Operator Station. The keyboard of the Operate<sup>IT</sup> Operator Station is used by the operator to enter commands which control the operation of the functional unit. The response to the operator's intervention is shown on the display screen of the Operate<sup>IT</sup> Operator Station. The application work for this part is normally limited to the arrangement of the display. Figure 2.1 shows the structure of the functional unit.

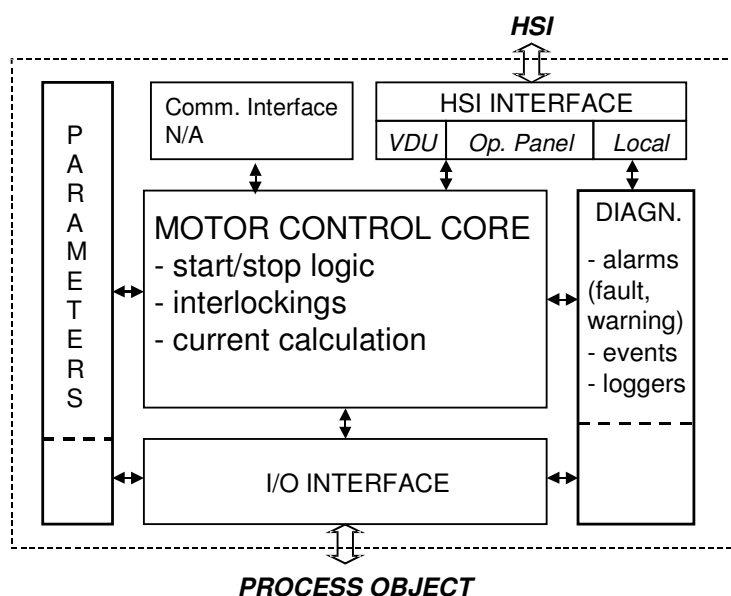


Figure 2-1. The Structure of the Functional Unit

## 3 Function Block MOTFREQ01

FUNCTION OF INPUT TERMINALS	MOTFREQ01		FUNCTION OF OUTPUT TERMINALS
Object name	Name	NoInt	No Interlocks
Object description	Description	NoICInt	No Safety Interlocks (IC)
Enable object	Enable	NoIBInt	No Process Interlocks (IB)
Enable control circuit alarm	ME	NoIAInt	No Sequence Interlocks (IA)
Control voltage	M1	Trip	Trip
Overload	M2	Blk	Standby
Motor breaker	M3	RFS	Ready for start
Emergency stop	M4	Ready	Motor Ready Indication in E1 or E2
Short Circuit	M5	SO1	Start order
Safety Interlock 1	IC1	SACK	Start order acknowledgement
Safety Interlock 2	IC2	StartWarn	Start warning
Safety Interlocks	ICs	Run	Running
Process Interlock 1	IB1	JogInd	Jog mode
Process Interlock 2	IB2	LocalInd	Local mode
Process Interlock 3	IB3	ManInd	Man mode
Process Interlock 4	IB4	E1Ind	E1 mode
Process Interlocks	IBs	E2Ind	E2 mode
Sequence Interlock 1	IA1	SP_Local	Local SP mode
Sequence Interlock 2	IA2	SP_Man	Man SP mode
Sequence Interlocks	IAs	SP_Ext	External SP mode
Start order pulse Time	T1	SP_OUT	Speed setpoint
Supervision Time	T2	Curr	Actual current (%)
Run interlock delay Time	T3	NormCurr	Normal current (%)
Start warning time	TWarn	NoOfStart	Number of start
Start order in E1 mode	E1Start	RunTime	Running time (in minutes)
Start order in E2 mode	E2Start	OutPar	Out Parameter
Stop order in external mode	Stop	Opr	Operator order
Main contactor acknowledge	Ack1		
Motor current	MC		
Order mode to Jog	JogEnbl		
Start order in Jog mode	JogStart		
Jog start hold function	JogFunc		
Order mode to Local	LEnbl		
Start order in Local mode	L1		
Local Stop order	LStop		
Order mode to Man	SeqMan		
Order mode to E1	SeqE1		
Order mode to E2	SeqE2		
Run Interlock 1	RunInt1		
Run Interlock 2	RunInt2		
Function for Run Interlock 2	RunInt2F		
Track A Enable - Bumpless from E1 to Auto	Track_A		
Track B Enable - Bumpless from Local to Auto	Track_B		
Motor Temperature	MotTemp		
Bearing Temperature	BearTemp		
Order SP Mode to Local	MV_LEnbl		
Order SP mode to Man	SeqManSP		
Order SP mode to External	SeqExtSP		
Speed Measured Value	MV		
Max setpoint change rate in External SP mode (unit/s)	Speed1		
External reference setpoint in External SP mode	ExtRef		
Block alarm	AlcBlk		
Acknowledge alarm	AlarmAck		
MC alarm configuration	MCAAlarm		
In Parameter	InPar		
Event name	EventName		

Figure 3-1. Function Block, Complete symbol

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Table 3-1 below illustrates the default properties of each terminal of MOTFREQ01 function block.

Name	Data Type	Attributes	Direction	FD Port	Initial value	Description
Name	string	coldretain	in	yes	'MotFreq'	Object name
Description	string	coldretain	in	yes	'Descr'	Object description
Enable	bool	coldretain	in	yes	true	Enable object
ME	bool	retain	in	yes	true	Enable control circuit alarm
M1	bool	retain	in	yes	true	Control voltage
M2	bool	retain	in	yes	true	Overload
M3	bool	retain	in	yes	true	Motor breaker
M4	bool	retain	in	yes	true	Emergency stop
M5	bool	retain	in	yes	true	Short Circuit
IC1	bool	retain	in	yes	true	Safety Interlock 1
IC2	bool	retain	in	yes	true	Safety Interlock 2
ICs	ICConn	by_ref	in	yes		Safety Interlocks
IB1	bool	retain	in	yes	true	Process Interlock 1
IB2	bool	retain	in	yes	true	Process Interlock 2
IB3	bool	retain	in	yes	true	Process Interlock 3
IB4	bool	retain	in	yes	true	Process Interlock 4
IBs	IBConn	by_ref	in	yes		Process Interlocks
IA1	bool	retain	in	yes	true	Sequence Interlock 1
IA2	bool	retain	in	yes	true	Sequence Interlock 2
IAs	IACConn	by_ref	in	yes		Sequence Interlocks
T1	time	coldretain	in	yes	2s	Start order pulse Time
T2	time	coldretain	in	yes	4s	Supervision Time
T3	time	coldretain	in	yes	5s	Run interlock delay Time
TWarn	time	coldretain	in	yes	0s	Start warning time
E1Start	bool	retain	in	yes		Start order in E1 mode
E2Start	bool	retain	in	yes		Start order in E2 mode
Stop	bool	retain	in	yes	true	Stop order in external mode
Ack1	bool	retain	in	yes		Main contactor acknowledge
MC	real	retain	in	yes		Motor current
JogEnbl	bool	retain	in	yes		Order mode to Jog
JogStart	bool	retain	in	yes		Start order in Jog mode
JogFunc	bool	retain	in	yes		Jog start hold function
LEnbl	bool	retain	in	yes		Order mode to Local
L1	bool	retain	in	yes		Start order in Local mode
LStop	bool	retain	in	yes	true	Local Stop order
SeqMan	bool	retain	in	yes		Order mode to Man
SeqE1	bool	retain	in	yes		Order mode to E1
SeqE2	bool	retain	in	yes		Order mode to E2
RunInt1	bool	retain	in	yes	true	Run Interlock 1
RunInt2	bool	retain	in	yes	true	Run Interlock 2
RunInt2F	bool	retain	in	yes		Function for Run Interlock 2
Track_A	bool	coldretain	in	yes	true	Track A Enable - Bumpless from E1 to Auto
Track_B	bool	coldretain	in	yes	true	Track B Enable - Bumpless from Local to Auto
MotTemp	bool	retain	in	yes	true	Motor Temperature
BearTemp	bool	retain	in	yes	true	Bearing Temperature
MV_LEnbl	bool	retain	in	yes		Order SP Mode to Local
SeqManSP	bool	retain	in	yes		Order SP mode to Man
SeqExtSP	bool	retain	in	yes		Order SP mode to External
MV	real	retain	in	yes		Speed Measured Value
Speed1	real	coldretain	in	yes	2.0	Max setpoint change rate in External SP mode (unit/s)
ExtRef	real	retain	in	yes		External reference setpoint in External SP mode
AlcBlk	bool	retain	in	yes		Block alarm
AlarmAck	bool	retain	in	yes		Acknowledge alarm
MCAAlarm	AlarmPar	by_ref	in	yes		MC alarm configuration
InPar	MotFreq_InPar	by_ref	in	yes		In Parameter

Name	Data Type	Attributes	Direction	FD Port	Initial value	Description
EventName	string	coldretain	in	yes	'  MotFreq_'	Event name
NoInt	bool	retain	out	yes		No Interlocks
NoCIInt	bool	retain	out	yes		No Safety Interlocks (IC)
NoBIInt	bool	retain	out	yes		No Process Interlocks (IB)
NoAIInt	bool	retain	out	yes		No Sequence Interlocks (IA)
Trip	bool	retain	out	yes		Trip
Blk	bool	retain	out	yes		Standby
RFS	bool	retain	out	yes		Ready for start
Ready	bool	retain	out	yes		Motor Ready Indication in E1 or E2
SO1	bool	retain	out	yes		Start order
SAck	bool	retain	out	yes		Start order acknowledgement
StartWarn	bool	retain	out	yes		Start warning
Run	bool	retain	out	yes		Running
JogInd	bool	retain	out	yes		Jog mode
LocalInd	bool	retain	out	yes		Local mode
ManInd	bool	retain	out	yes		Man mode
E1Ind	bool	retain	out	yes		E1 mode
E2Ind	bool	retain	out	yes		E2 mode
SP_Local	bool	retain	out	yes		Local SP mode
SP_Man	bool	retain	out	yes		Man SP mode
SP_Ext	bool	retain	out	yes		External SP mode
SP_OUT	real	retain	out	yes		Speed setpoint
Curr	real	retain	out	yes		Actual current (%)
NormCurr	real	retain	out	yes		Normal current (%)
NoOfStart	dint	coldretain	out	yes		Number of start
RunTime	real	coldretain	out	yes		Running time (in minutes)
OutPar	MotFreq_OutPar	by_ref	out	yes		Out Parameter
Opr	MotFreq_Opr	by_ref	out	yes		Operator order

Table 3-1 Terminal Properties

## 4 MotFreq Datatypes

### 4.1 MotFreq\_InPar

Name	Data Type	Attributes	Initial value	ISP value	Description
Class	dint	coldretain	500		AE class
Severity	dint	coldretain	1000		AE severity
SpeedRange	RangeReal	coldretain			Speed Range
SpeedSPLimit	RangeLimit	coldretain			Speed SP limit
InitMode	dint	coldretain	5		Init mode (5 = Man ; 7 = E1 ; 8 = E2)
InitSPMode	dint	coldretain	2		Init SP mode (1= Local SP ; 2= Man SP ; 3= ExtSP)
JogBlk	bool	coldretain	false		Block operator order Jog mode
LocalBlk	bool	coldretain	false		Block operator order Local mode
ManBlk	bool	coldretain	false		Block operator order Man mode
E1Blk	bool	coldretain	false		Block operator order E1 mode
E2Blk	bool	coldretain	false		Block operator order E2 mode
LocalSPBlk	bool	coldretain	false		Block operator order Local SP mode
ManSPBlk	bool	coldretain	false		Block operator order Man SP mode
ExtSPBlk	bool	coldretain	false		Block operator order Ext SP mode
StartBlk	bool	coldretain	false		Block operator order Start command
StopBlk	bool	coldretain	false		Block operator order Stop command
AlcBlkEvBlk	bool	coldretain	true		Block event for AlcBlk
LEnblEvBlk	bool	coldretain	true		Block event for LEnbl
JogEnblEvBlk	bool	coldretain	true		Block event for JogEnbl
SeqManEvBlk	bool	coldretain	true		Block event for SeqMan
SeqE1EvBlk	bool	coldretain	true		Block event for SeqE1
SeqE2EvBlk	bool	coldretain	true		Block event for SeqE2
SeqManSPEvBlk	bool	coldretain	true		Block event for SeqManSP
SeqExtSPEvBlk	bool	coldretain	true		Block event for SeqExtSP
MVLEnblEvBlk	bool	coldretain	true		Block event for MV_LEnbl
ExtStartEvBlk	bool	coldretain	true		Block event for ExtStart
ExtStopEvBlk	bool	coldretain	true		Block event for ExtStop
IABlockNotExtMode	bool	coldretain	true		IA blocked when not in E1 or E2 mode
IA1	IAnParType1	coldretain			Configuration for IA1
IA2	IAnParType1	coldretain			Configuration for IA2
IAs1	IAnParType1	coldretain			Configuration for IAs.IA1
IAs2	IAnParType1	coldretain			Configuration for IAs.IA2
IB1	IBInParType1	coldretain			Configuration for IB1
IB2	IBInParType1	coldretain			Configuration for IB2
IB3	IBInParType1	coldretain			Configuration for IB3
IB4	IBInParType1	coldretain			Configuration for IB4
IBs1	IBInParType1	coldretain			Configuration for IBs.IB1
IBs2	IBInParType1	coldretain			Configuration for IBs.IB2
IBs3	IBInParType1	coldretain			Configuration for IBs.IB3
IBs4	IBInParType1	coldretain			Configuration for IBs.IB4
IBs5	IBInParType1	coldretain			Configuration for IBs.IB5
IBs6	IBInParType1	coldretain			Configuration for IBs.IB6
IBs7	IBInParType1	coldretain			Configuration for IBs.IB7
IBs8	IBInParType1	coldretain			Configuration for IBs.IB8
IC1	ICInParType1	coldretain			Configuration for IC1
IC2	ICInParType1	coldretain			Configuration for IC2
ICs1	ICInParType1	coldretain			Configuration for ICs.IC1
ICs2	ICInParType1	coldretain			Configuration for ICs.IC2
RatedCurr	real	coldretain	100.0		Rated current
NormalCurr	real	coldretain	50.0		Normal current
CurrUnit	string	coldretain	'A'		Current unit
ShowCurrent	bool	coldretain	false		Show current presentation
ResetSP	bool	coldretain	false		Reset SP when stopping motor in Man Mode
AEConfigBTemp	dint	coldretain	0		AE configuration for Bearing Temperature
AEConfigM1	dint	coldretain	1		AE configuration for M1

Name	Data Type	Attributes	Initial value	ISP value	Description
AEConfigM2	dint	coldretain	1		AE configuration for M2
AEConfigM3	dint	coldretain	1		AE configuration for M3
AEConfigM4	dint	coldretain	1		AE configuration for M4
AEConfigM5	dint	coldretain	1		AE configuration for M5
AEConfigMCErr	dint	coldretain	1		AE configuration for Main Contactor Error
AEConfigMTemp	dint	coldretain	0		AE configuration for Motor Temperature
AEConfigRInt1	dint	coldretain	0		AE configuration for Run Interlock 1
AEConfigRInt2	dint	coldretain	0		AE configuration for Run Interlock 2
EnNoOfStartCounter	bool	coldretain	false		Enable number of start counter
EnRunTimeCounter	bool	coldretain	false		Enable running time counter

#### 4.2 MotFreq\_OutPar

Name	Data Type	Attributes	Initial value	ISP value	Description
AlarmBlk	bool	retain			Alarm blocked
IntlkBlk	bool	retain			Interlock blocked
IntlkBlkActive	bool	retain			Interlock blocked active
EnOverrideAll	bool	retain			Override All button enabled
Mode	dint	retain			Active mode
SPMode	dint	retain			Active SP mode
NormalMode	bool	retain			Normal mode (Active mode = Init mode)
NormalSPMode	bool	retain			Normal SP mode (Active SP mode = Init SP mode)
IA1Ind	bool	retain			IA1 interlocked
IA2Ind	bool	retain			IA2 interlocked
IB1Ind	bool	retain			IB1 interlocked
IB2Ind	bool	retain			IB2 interlocked
IB3Ind	bool	retain			IB3 interlocked
IB4Ind	bool	retain			IB4 interlocked
IC1Ind	bool	retain			IC1 interlocked
IC2Ind	bool	retain			IC2 interlocked
IAs1Ind	bool	retain			IAs1 interlocked
IAs2Ind	bool	retain			IAs2 interlocked
IBs1Ind	bool	retain			IBs1 interlocked
IBs2Ind	bool	retain			IBs2 interlocked
IBs3Ind	bool	retain			IBs3 interlocked
IBs4Ind	bool	retain			IBs4 interlocked
IBs5Ind	bool	retain			IBs5 interlocked
IBs6Ind	bool	retain			IBs6 interlocked
IBs7Ind	bool	retain			IBs7 interlocked
IBs8Ind	bool	retain			IBs8 interlocked
ICs1Ind	bool	retain			ICs1 interlocked
ICs2Ind	bool	retain			ICs2 interlocked
BTemp	AlarmInd	retain			Alarm Indication for BearingTemp
MTemp	AlarmInd	retain			Alarm Indication for MotorTemp
HCurr	AlarmInd	retain			Alarm Indication for HCurr
M1	AlarmInd	retain			Alarm Indication for M1
M2	AlarmInd	retain			Alarm Indication for M2
M3	AlarmInd	retain			Alarm Indication for M3
M4	AlarmInd	retain			Alarm Indication for M4
M5	AlarmInd	retain			Alarm Indication for M5
MCErr	AlarmInd	retain			Alarm Indication for MCErr
RInt1	AlarmInd	retain			Alarm Indication for RInt1
RInt2	AlarmInd	retain			Alarm Indication for RInt2
LastStop	dint	retain			Reason for last stop
StartTime	time	retain			Actual starting time
StopTime	time	retain			Actual stopping time

### 4.3 MotFreq\_Opr

Name	Data Type	Attributes	Initial value	ISP value	Description
BlockAlarm	bool	retain			Operator block alarms
Jog	bool	retain			Operator order Jog mode
Local	bool	retain			Operator order Local mode
Man	bool	retain			Operator order Manual mode
E1	bool	retain			Operator order E1 mode
E2	bool	retain			Operator order E2 mode
Start	bool	retain			Operator order Start command
Stop	bool	retain			Operator order Stop command
LocalSP	bool	retain			Operator order Local SP mode
ManSP	bool	retain			Operator order Man SP mode
ExtSP	bool	retain			Operator order Ext SP mode
OverrideAll	bool	retain			Operator override all interlocks
IB1Override	bool	retain			Operator override IB1 interlock
IB2Override	bool	retain			Operator override IB2 interlock
IB3Override	bool	retain			Operator override IB3 interlock
IB4Override	bool	retain			Operator override IB4 interlock
IBs1Override	bool	retain			Operator override IBs.IB1 interlock
IBs2Override	bool	retain			Operator override IBs.IB2 interlock
IBs3Override	bool	retain			Operator override IBs.IB3 interlock
IBs4Override	bool	retain			Operator override IBs.IB4 interlock
IBs5Override	bool	retain			Operator override IBs.IB5 interlock
IBs6Override	bool	retain			Operator override IBs.IB6 interlock
IBs7Override	bool	retain			Operator override IBs.IB7 interlock
IBs8Override	bool	retain			Operator override IBs.IB8 interlock
IA1Override	bool	retain			Operator override IA1 interlock
IA2Override	bool	retain			Operator override IA2 interlock
IAs1Override	bool	retain			Operator override IAs.IA1 interlock
IAs2Override	bool	retain			Operator override IAs.IA2 interlock
SP	real	coldretain	0.0		Operator enter manual SP
ResetCounter	bool	retain			Order reset counter

## 5 Function Description

### 5.1 Basic Properties

The MOTFREQ01 functional unit is designed for the control of variable speed motors, i.e. AC-Drives.

MOTFREQ01 units consist of the following basic functions.

- Supervision of control circuits
- Evaluation of interlocks
- Control of on/off
- Supervision of motor current
- Running of tests from the motor site
- Control from the local operator's panel
- Manual/External running
- Supervision of operations via Operate<sup>IT</sup> Operator Station
- Speed Setpoint Control

### 5.2 Motor Control Modes

MOTFREQ01 is intended for control from Operate<sup>IT</sup> Operator Station i.e. from a central control room. However, it is also possible to select other modes of control and thus control MOTFREQ01 from other locations.

All the control modes can be selected from the central operator station. The LOCAL control mode may also be selected from the local control station.

The different modes of control are as follows:

- Jog
- Local
- Manual
- External 1
- External 2

By selecting control mode, the operator decides from which location the motor is to be controlled. All control modes may be selected through dialog in Operate<sup>IT</sup> Operator Station. The LOCAL control mode may also be selected from the local control station through the Function Block input :LE, provided that the current control mode is neither JOG, nor DISABLE.

For the different control modes, MOTFREQ01 is controlled as follows. For a summary of the control modes, see Table 3-1.

### 5.2.1 JOG

The control mode JOG is suitable for testing the motor in the field. The motor is supposed to be controlled from a stop/start station adjacent to the motor. Control from other locations is blocked. When the motor is leaving Jog mode a stop order is generated automatically.

The supervision of interlocks is limited. Only the safety interlocks SafetyInt1 and SafetyInt 2 as well as faults in the control voltage chain (the inputs :M1 - :M5) prevent starting.

The motor is started and stopped through the inputs :JogStart and :JogFunc.

:JogStart, Start order from field-mounted start/stop station

:JogFunc, Stop/Hold function from field-mounted start/stop station

The function of these inputs is set out in tabular form below.

<b>:JogStart</b>	<b>:JogFunc</b>	
0	0	Stop order.
0	1	No change.
1	0	Start and stop order in :JogStart input.
1	1	Start order on :JogStart and stop order on :JogFunc.

When :JogFunc=1, the motor is stopped by breaking the control voltage chain, i.e. signified by any of the :M1 - :M5 inputs going low.

### 5.2.2 LOCAL

The motor is controlled from a local desk or panel. Control from other locations is blocked.

LOCAL control mode, like other points of control, may be selected from Operate<sup>IT</sup> Operator Station. In addition, LOCAL control mode may be selected from the local control panel through the input :LEnbl as follows:

:LEnbl = 1: The control mode is LOCAL, as long as the Operate<sup>IT</sup> Operator Station operator does not request JOG or STAND BY. All other control modes are blocked and :LEnbl must be released before a mode change can occur.

LEnbl -> 0: MOTFREQ01 resumes the either the previous or the latest control mode called for from Operate<sup>IT</sup> Operator Station.

The operator controls the motor through the inputs :Lstart and :LStop.

:LStop Local stop order (active low)

:Lstart Local start order

The function of these inputs is set out in tabular form below.

<b>:Lstop</b>	<b>:Lstart</b>	
0	X	Stop order. Note In order for the motor to start when LStop has been low, LStop must be set high and LStart must make a low-to-high transition
1	0	No change
1	1	Start order

### 5.2.3 MANUAL

The motor is controlled from Operate<sup>IT</sup> Operator Station. Control from other locations is blocked. This is the default control mode. To start, the operator has to press the key START. To stop the motor, the key STOP has to be pressed.

### 5.2.4 EXTERNAL 1 and EXTERNAL 2

The motor is controlled from external signals, e.g. from a process signal. Control from other locations is blocked. This mode is e.g. used for on/off control of levels and for automatic start up and shutdown of belt conveyors etc.

EXTERNAL 2 functions in exactly the same way as EXTERNAL 1. EXTERNAL 2 is used when the motor is to be controlled by Level 2 application software e.g. Auto Series Software.

The function is enabled by inputs :SeqE1 and :SeqE2.

The process controls the motor through the inputs :E1Start, :E2Start and :Stop. The operator is able to stop the motor by issuing stop order from Operate<sup>IT</sup> Operator Station. The control mode then changes to Manual, to prevent the motor from being restarted.

**:Stop** Stop order (active low)

**:StartE1(2)** Start order

The function of these inputs is set out in tabular form below:

<b>:Stop</b>	<b>:StartE1(2)</b>	
0	X	Stop order
1	0 -> 1	Start order

**:StartE1(2)** are dynamic inputs, i.e. they trigger on the rising edge.

### 5.2.5 DISABLED

The motor is stopped and all orders to it are blocked. Used to take the motor Out of Service.

## 5.3 Setpoint Modes

As for the Motor Control Modes above the speed setpoint can also be entered from a local control station (the frequency converters control panel), or from the Operate<sup>IT</sup> Operator Station or from a program in the AC800M.

The different setpoint modes are as follows:

- Local
- Manual
- External

By selecting setpoint mode, the operator decides from which location the setpoint is to be controlled. All setpoint modes may be selected through dialog in Operate<sup>IT</sup> Operator Station.

There is no correlation between motor control modes and setpoint modes i.e. when the motor is controlled using LOCAL this does not mean that the Setpoint changes mode to LOCAL too. If this functionality is required then the logic will need to be programmed externally to the function block. All motor control modes are not affected by changes in the Setpoint modes.

For the different setpoint modes, MOTFREQ01 is controlled as follows:

### 5.3.1 LOCAL Setpoint

The LOCAL setpoint mode may be selected from the local control station by using the Function Block input :MV\_Lenbl, or through the dialog in Operate<sup>IT</sup> Operator Station, provided function block is not disabled. All other setpoint modes are blocked and :MV\_LEnbl must be released before a mode change can occur.

The setpoint mode LOCAL is suitable entering a Setpoint from the frequency converter or from a local panel next to the motor. Setpoints from other modes are blocked. The output terminal :SP\_Local in the function block is set true indicating the mode is active.

In LOCAL mode the output terminal :SP\_OUT does not provide a setpoint to the frequency converter because the frequency converter itself is providing this. The value of the Speed Indicator Input: MV is transferred to the output terminal: SP\_OUT.

### 5.3.2 MANUAL Setpoint

The MANUAL setpoint mode is selected by using the Function Block input: SeqManSP or through the dialog in Operate<sup>IT</sup> Operator Station, provided that function block is not disabled.

When in MANUAL setpoint mode it is possible to change the speed of the motor by entering the desired setpoint. Setpoints from other modes are blocked but it is still possible to change to these modes from the dialog in Operate<sup>IT</sup> Operator Station. The desired value is then available on the output: SP\_OUT terminal. The output terminal: SP\_Man in the function block is set true indicating the mode is active.

### 5.3.3 EXTERNAL Setpoint

The EXTERNAL setpoint mode is selected by using the Function Block input: SeqExtSP or through the dialog in Operate<sup>IT</sup> Operator Station, provided that function block is not disabled.

The EXTERNAL mode enables a setpoint to be provided from an external signal e.g. from a PID controllers output. Setpoints from other modes are blocked but it is still possible to change to these modes from the dialog in Operate<sup>IT</sup> Operator Station

The value at input terminal :EXTREF in the function block is then available at the output terminal: SP\_OUT. The output terminal: SP\_Ext in the function block is set true indicating the mode is active.

#### 5.4 Setpoint Speed

Terminal :Speed1 is a coefficient used to restrict the ramp speed of the setpoint. The value entered is the slope of the curve required. This value will depend on the range of the setpoint. All setpoint changes are restricted by the ramp speed in all modes excepting Local setpoint mode. When changing to local mode from manual mode and external mode the local modes setpoint is indicated directly. In Local mode the setpoint is only displayed in MOTFREQ01, and setpoint speed has no affect.

Setpoint Speed Coefficient = Setpoint Range / Ramp Time Required

#### 5.5 Setpoint Tracking

The setpoint tracking function is enabled by terminals :Track\_A and :Track\_B.

Track\_A is used to retain the external setpoint when changing mode from External to Manual.

Track\_B is used to retain the local setpoint when changing mode from Local to Manual.

#### 5.6 Ready for Start

Ready for start means that all the interlocks are satisfied, that there are no alarms and that the control mode is not JOG or that the control is DISABLED.

Ready for start is indicated by the MOTFREQ01 displays in the Operate<sup>IT</sup> Operator Station and by the output terminal :RFS (Ready For Start) in the function block.

#### 5.7 Ready

The output terminal: READY has the same functionality as the terminal: RFS but the motor has to be in External 1 or External 2 mode for the output to be set. This terminal is used in sequence applications to check the status of the motor i.e. when the motor is part of a sequence or group start.

#### 5.8 Start-up

An initialisation phase begins at start of the AC800M system.

The result of this becomes:

The outputs are reset (to zero) except for the ManInd terminal, which is set (to 1).

Manual is the default control mode at system initialisation for both the motor and the setpoint. With additional function block logic it is possible to force the control mode to other modes at system initialisation.

#### 5.9 Interlocks

The motor control can be interlocked by signals from the process and also by signals from the control logic. The interlocks are divided into four groups with the following designations and functions.

**Safety Interlocks**, which interlock the object for safety purposes. The two safety interlocks, :IC1 and :IC2, cannot be blocked.

**Process Interlocks.** There are 4 normal process interlocks, :IB1 to :IB4. All four interlocks can be configured to accept blocking by the operator. All four interlocks can also be configured as start interlocks. A start interlock will prevent the motor from starting, but will not stop a running motor.

**External (Sequence) Interlocks.** Interlocks on terminals :IA1 and :IA2 are used if the object is to be interlocked against other objects such as a pump motor or a group start or other conditions in an automatic sequence. These interlocks are configurable as blocked or not when not in E1 resp. E2 mode.

If *IA blocked when not Ext* is equal to 1

Motor interlocked if IA1 is 0 and the motor is in E1 mode

Motor interlocked if IA2 is 0 and the motor is in E2 mode

If *IA blocked when not Ext* is equal to 0

Motor interlocked if IA1 or IA2 is 0 and the motor is in Man, E1, E2 or Local mode

The interlocks are not included in the conditions for indication of Ready for start.

**Run Interlocks.** The inputs :RunInt1 and :RunInt2 are intended for connection to operation monitors to obtain tripping or alarm in the event of faults. The inputs are to be TRUE when the equipment is faultless. In order to allow the motor to reach operational speed, RunInt1 and RunInt2 are blocked during the time :T3 after start-up. When the JOG control mode is selected, RunInt1 and RunInt2 are blocked. When RunInt1 or RunInt2 goes to 0, MOTFREQ01 remembers this error status until the alarm is acknowledged. Input :RunInt1 has a motor tripping function whereas the input :RunInt2 function can be controlled with the parameter :RunInt2F. When input :RunInt2F = TRUE, the motor is tripped. With .RunInt2F = FALSE, only an alarm is given. Alarm handling of :RunInt1 and :RunInt2 is blocked internally in the Function Block with the motor at standstill.

An interlocking is active when the input is 0 (FALSE). All Process and External interlocks are blocked when the JOG control mode is selected.

## 5.10 Motor Alarms

Input terminals :MotTemp indicates that the motor has overheated. Terminal :BearTemp indicates that the motor bearings have overheated. Both inputs terminals do not trip the motor but provide an alarm to the operator.

## 5.11 Start and Stop

Start and stop commands for MOTFREQ01 may originate from dialog with Operate<sup>IT</sup> Operator Station or from Function Block inputs, depending on the control mode selected (See Section 5.2 Motor Control Modes, and Table 3.1).

When a start command is issued to MOTFREQ01, it is first checked if a startwarning should be given. A startwarning is given at terminal :StartWarn if the time :TWarn (Startwarning time) is greater than zero. After the time :TWarn has expired the startorder is forwarded to the motor through the Function Block output :SO1 (Start order 1, Forwards/ High). See Section 5.11.2 Start Order Selection. The start order on the output :SO1 is a pulse with a duration which is determined by the input :T1.

The main contactor of the motor acknowledges the start order :SO1 by setting the input :ACK1 high. The main contactor must acknowledge within the time determined by the input :T2. The time T2 ought to be set longer than T1.

If the main contactor acknowledges the start order pulse :SO1 within the time T2, MOTFREQ01 sets the start order output :SO1 high and keeps it high. The time T3 after

the main contactor having responded, MOTFREQ01 starts supervising the motor current. The time T3 is determined by the input :T3

If the main contactor does not acknowledge the start order within the time T2, the start attempt is deemed abortive. Consequently, MOTFREQ01 issues an alarm about the contactor failure and a new attempt at starting may be made.

The contactor failure alarm indication on the object display of MOTFREQ01 disappears when the operator acknowledges the alarm.

MOTFREQ01 also issues an alarm about main contactor failure when the contactor acknowledges start orders falsely, i.e. when it sets the inputs :ACK1 high without any start order being issued. MOTFREQ01 transmits the alarm the time T2 after the input having been set.

#### 5.11.1 Start and Stop Order at Different Motor Control Modes

The table below describes the commands which can be given at the different control modes of MOTFREQ01.

Table 3-1. Relation between commands and control modes

<b>Order</b>	<b>Jog</b>	<b>Local</b>	<b>Manual</b>	<b>Ext1</b>	<b>Ext2</b>
Input JogStart	Start Stop	-	-	-	-
Input Lstart	-	Start	-	-	-
Input Lstop	-	Stop	-	-	-
Operator start	-	-	Start	-	-
Operator stop	-	-	Stop	Stop	Stop
Input StartE1	-	-	-	Start	-
Input StartE2	-	-	-	-	Start
Stop	-	-	-	Stop	Stop

#### 5.11.2 Start Order Selection

The Function Block MOTFREQ01 has one start order output:

:SO1          Start order 1, Forwards/High

The activation of the output is determined as follows from the different points of control.

5.11.2.1 Control mode JOG  
 FB input :JogStart

5.11.2.2 Control mode LOCAL  
 FB input :LStart

5.11.2.3 Control mode MAN  
 The operator issues a Start order from Operate<sup>IT</sup> Operator Station.

5.11.2.4 Control mode Ext1 or Ext2  
 An superior control program sets the input :StartE1 or :StartE2 to issue a new start order.  
 See the table below.

:StartE1(2)	Stop	Descr
0	0	No change.
1	0	No change.
1	1	Start order

5.11.2.5 Control mode DISABLE  
 The motor cannot be started.

5.11.3 Operator Order and Order Blocking  
 The different orders given by the operator can be read at the output terminal :OprOrder.  
 Blocking of operator order also possible from the control program by setting the corresponding bits in the terminal :OrdBlk.

## 5.12 Fault Evaluation in the Control Circuit

Evaluation is performed in the priority order M1 to M5. This means that if the Input :M1 =0, the inputs :M2 - :M5 are not regarded etc. The signal ME interlocks the complete evaluation. ME=0 is used to prevent incorrect alarms with, for example, a total control voltage failure. The inputs M1 to M5 are to be TRUE when there are no errors. The evaluation presupposes that the control circuit consists of a number of breaking contacts in series.

No alarm will be generated if the motor is not running. The presentation elements will show the faulty state.

### 5.13 Supervision of Load Control

The input MC is connected to the process signal for LOAD indication (Motor Current in MOTCON). This input on the function block is scalable and can be used to present the motor current or more aptly for frequency converters, the torque or power indication. In the function block the correct measurement range and engineering units can be entered. These will then be presented accordingly in the Faceplate and Object display in the Operate<sup>IT</sup> Operator Station.

*Info:* Most modern AC Drives are have programmable outputs so that the correct signal can be configured for power or torque and sent to the MC input.

### 5.14 Interaction Window

The interaction window is available in the Control<sup>IT</sup> Control Builder. The interaction window is an engineering aid used to simplify configuration and blocking of signals not available on the faceplates. Changes to values in the Interaction window are only available in 'Online' mode in Control<sup>IT</sup>.

#### 5.14.1 MOTFREQ Interaction Window

Interaction window overview. Name and description are shown. The buttons are links to sub-windows.

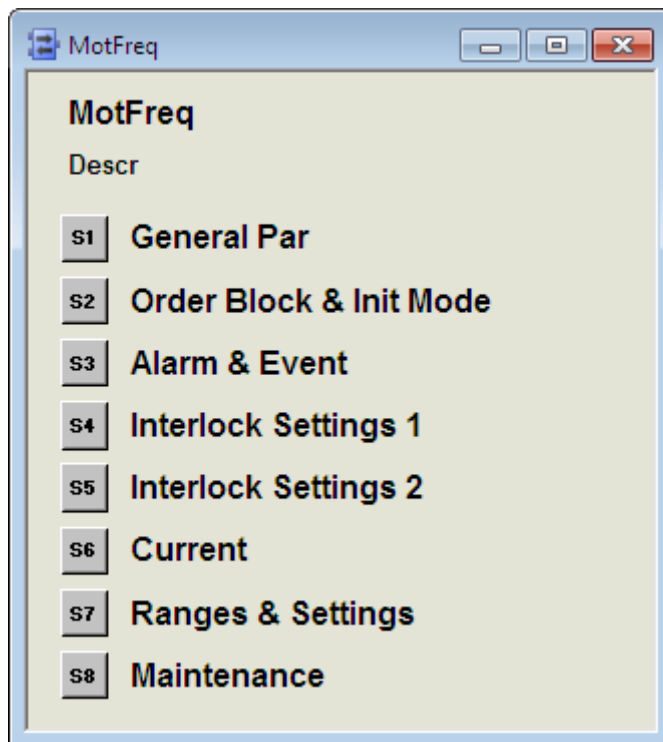


Figure 4-1 Main Interaction Window.

#### 5.14.2 General Parameters

“Class” defines the process section or area in which alarms are grouped. By utilizing class the alarms can be filtered. Valid values are user defined. A suggestion would be to use mill area numbers as class values.

“Severity” defines the alarm priority for general alarms. The severity for MV-alarms is entered in window “Alarm & Event”. Valid values are 1 –1000 where 1000 is the highest priority.

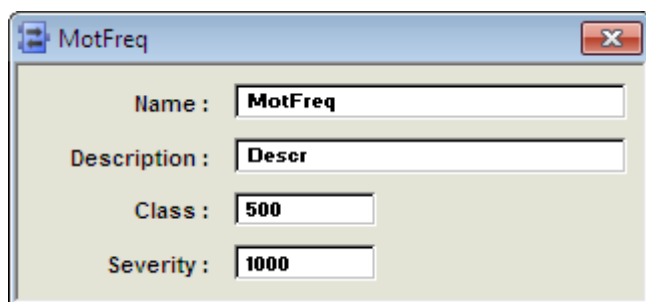


Figure 4-2 General Parameters.

### 5.14.3 Order Block

Blocking of operator order are entered in this window.

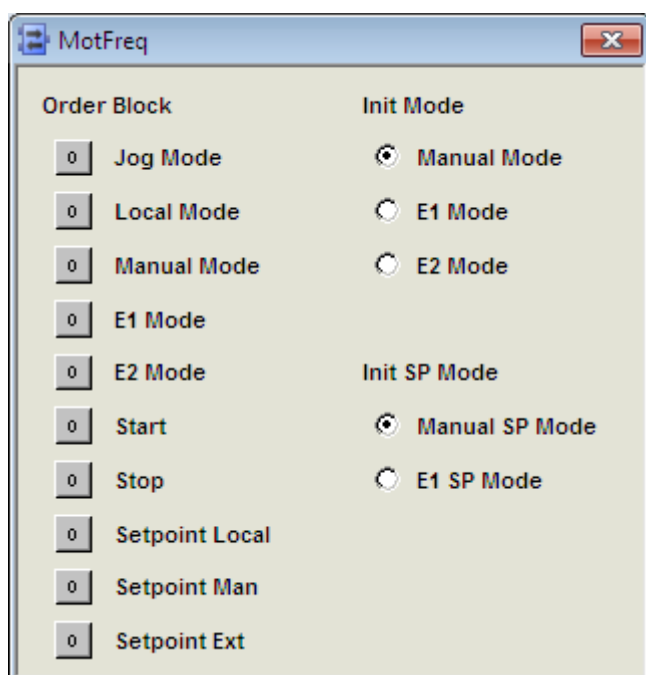


Figure 4-3 Order Block.

### 5.14.4 Alarm configuration and Event Blocking

Alarm and Events are generated for status change on the signals defined in interaction window.

All Operator Events are reported by Audit Trail Functionality and not included in the FunctionBlock.

The individual text string for each event is stored in the Alarm and Event Translator aspect. This text can be NLS handled.

For AE config the following values are valid

- 0 No Alarm or Event are generated
- 1 Alarm and Event are generated
- 2 Event is generated

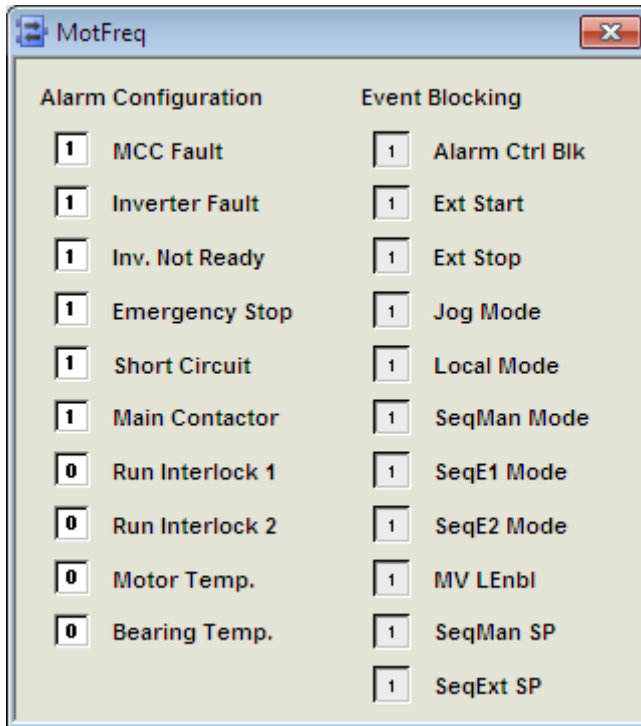


Figure 4-4 Indication Event Block.

#### 5.14.5 Interlock Settings

The different settings for interlocks are entered in this window.

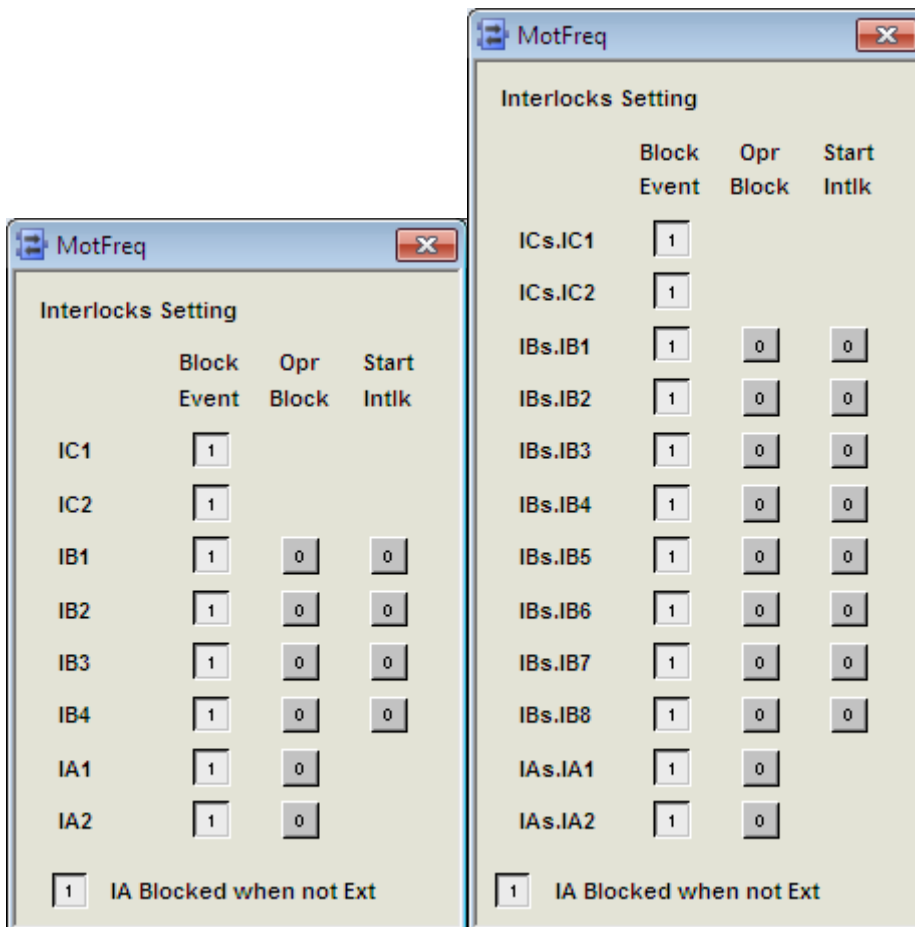


Figure 4-5 Interlock Settings.

### 5.14.6 Current settings

Motor nominal (rated) current and normal current is entered in this window.  
The actual current is also indicated.

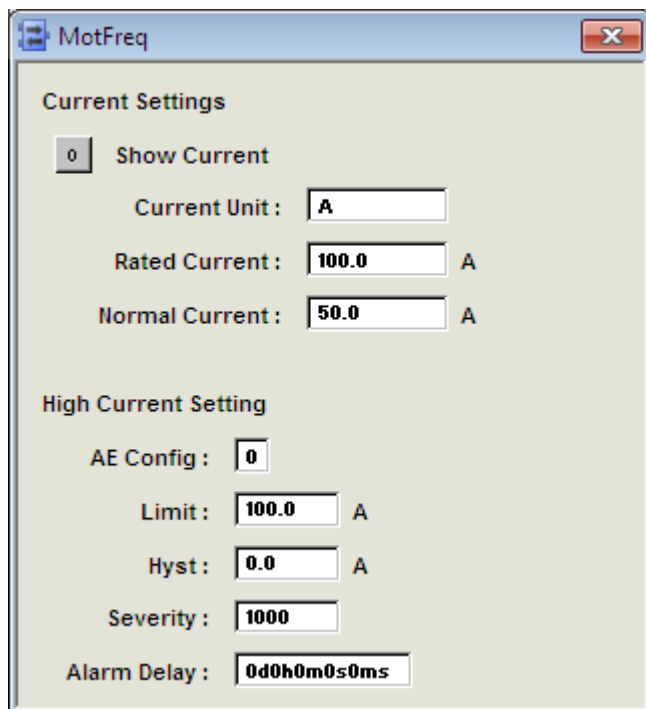


Figure 4-6 Current settings.

### 5.14.7 Texts

The different interlock and information texts are entered in the aspect Text Properties. The length of the text is limited to about 60 characters, by the size of presentation element in the Interlock Display.

Name	Value	Type	Description	Readable?	R/Permission	Writable?	W/Permission	Deploy Scheme
M1Text	Control Voltage	String	M1 Text	Yes		Yes	Configure	Always Repla
M2Text	Overload	String	M2 Text	Yes		Yes	Configure	Always Repla
M3Text	Motor Breaker	String	M3 Text	Yes		Yes	Configure	Always Repla
M4Text	Emergency Stop	String	M4 Text	Yes		Yes	Configure	Always Repla
M5Text	Short Circuit	String	M5 Text	Yes		Yes	Configure	Always Repla
IC1Text		String	IC1 Interlock Text	Yes		Yes	Configure	Always Repla
IC2Text		String	IC2 Interlock Text	Yes		Yes	Configure	Always Repla
ICs								
ICs.IC1Text		String	ICs.IC1 Interlock Te	Yes		Yes	Configure	Always Repla
ICs.IC2Text		String	ICs.IC2 Interlock Te	Yes		Yes	Configure	Always Repla
IB1Text		String	IB1 Interlock Text	Yes		Yes	Configure	Always Repla
IB2Text		String	IB2 Interlock Text	Yes		Yes	Configure	Always Repla
IB3Text		String	IB3 Interlock Text	Yes		Yes	Configure	Always Repla
IB4Text		String	IB4 Interlock Text	Yes		Yes	Configure	Always Repla
IBs								
IBs.IB1Text		String	IBs.IB1 Interlock Te	Yes		Yes	Configure	Always Repla
IBs.IB2Text		String	IBs.IB2 Interlock Te	Yes		Yes	Configure	Always Repla
IBs.IB3Text		String	IBs.IB3 Interlock Te	Yes		Yes	Configure	Always Repla
IBs.IB4Text		String	IBs.IB4 Interlock Te	Yes		Yes	Configure	Always Repla
IBs.IB5Text		String	IBs.IB5 Interlock Te	Yes		Yes	Configure	Always Repla
IBs.IB6Text		String	IBs.IB6 Interlock Te	Yes		Yes	Configure	Always Repla
IBs.IB7Text		String	IBs.IB7 Interlock Te	Yes		Yes	Configure	Always Repla
IBs.IB8Text		String	IBs.IB8 Interlock Te	Yes		Yes	Configure	Always Repla
IA1Text		String	IA1 Interlock Text	Yes		Yes	Configure	Always Repla
IA2Text		String	IA2 Interlock Text	Yes		Yes	Configure	Always Repla
IAs								
IAs.IA1Text		String	IAs.IA1 Interlock Te	Yes		Yes	Configure	Always Repla
IAs.IA2Text		String	IAs.IA2 Interlock Te	Yes		Yes	Configure	Always Repla
RunInt1Text		String	RunInt1 Interlock Te	Yes		Yes	Configure	Always Repla
RunInt2Text		String	RunInt2 Interlock Te	Yes		Yes	Configure	Always Repla
ExtSPName		String	ExtSP Name	Yes		Yes	Configure	Always Repla
Info1Text		String	Info 1 Text	Yes		Yes	Configure	Always Repla
Info2Text		String	Info 2 Text	Yes		Yes	Configure	Always Repla

Figure 4-7 Texts.

5.14.8 Ranges & Settings

In this window the range and unit for Measured value and Setpoint is entered.

If SP Start Value Enable is set to 1 the Manual SP will be set to SP Min when the motor is stopped.

MotFreq

**Ranges & Settings**

MV Max :

MV Min :

MV Unit :

Decimal :

SP HLim :

SP LLim :

SP Start Value Enable

Figure 4-8 Ranges & Settings.

5.14.9 Maintenance

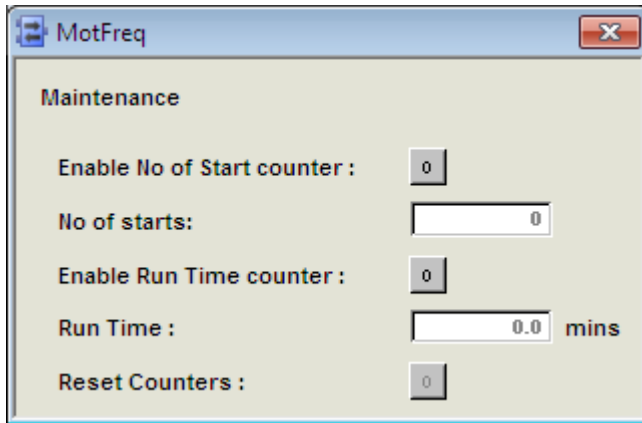


Figure 4-8 Maintenance

## 6 Operator Functions

The Operator functions are divided in principle into 4 parts:

- Presentation (Display elements, Time logged properties)
- Faceplate (Dialog)
- Alarm and Event handling
- Text handling

### 6.1 Presentation

#### 6.1.1 Display elements

Display elements which can be used for different display types are available for use in the functional unit MOTFREQ.

The display elements show the status and the controls of the process with different degrees of detail and is intended for the following displays:

- Object display
- Process display
- Interlock Display

Examples of different display elements which could be used in these displays are given in the following sections.

6.1.1.1 Object Display

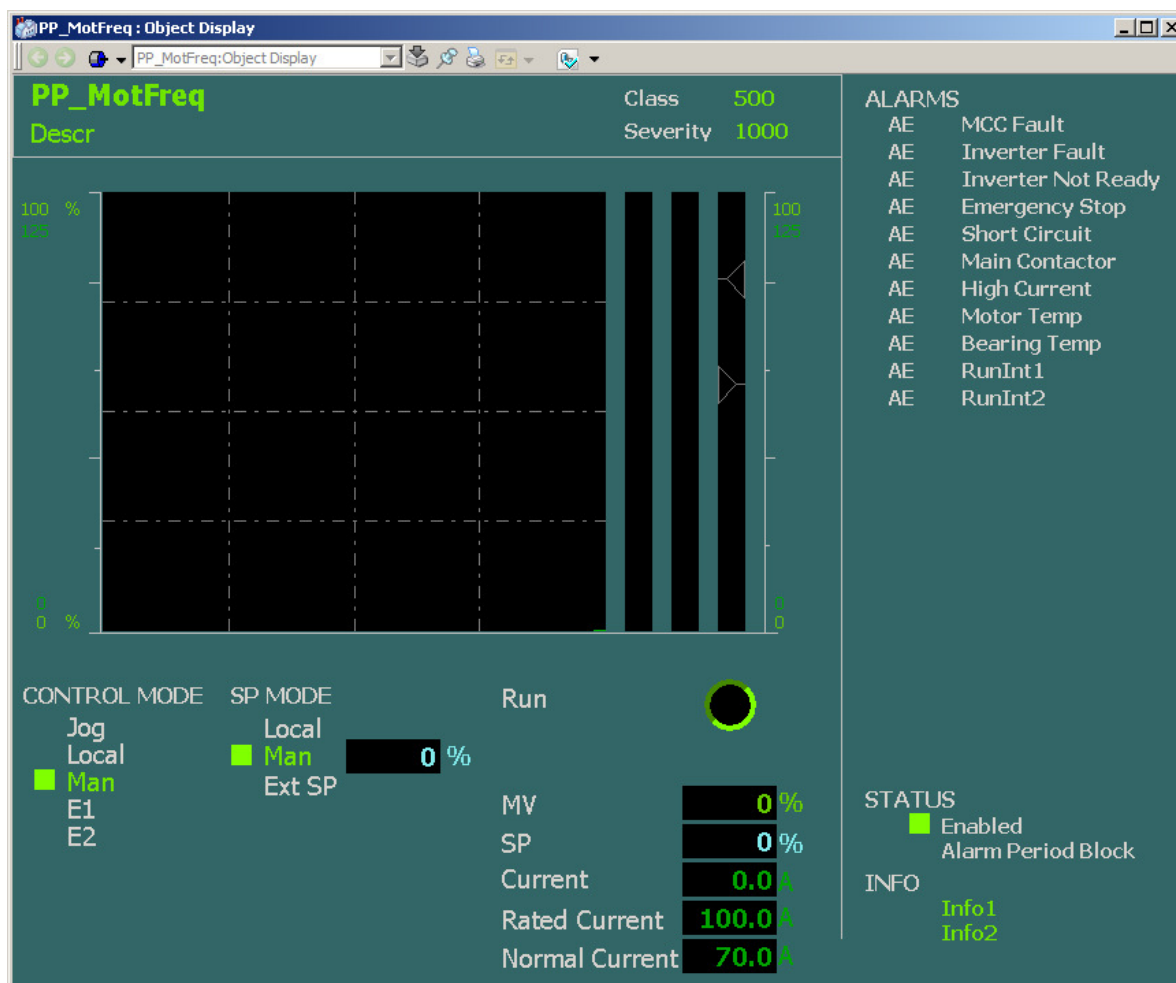


Figure 5-1 Object Display

6.1.1.2 Process Display



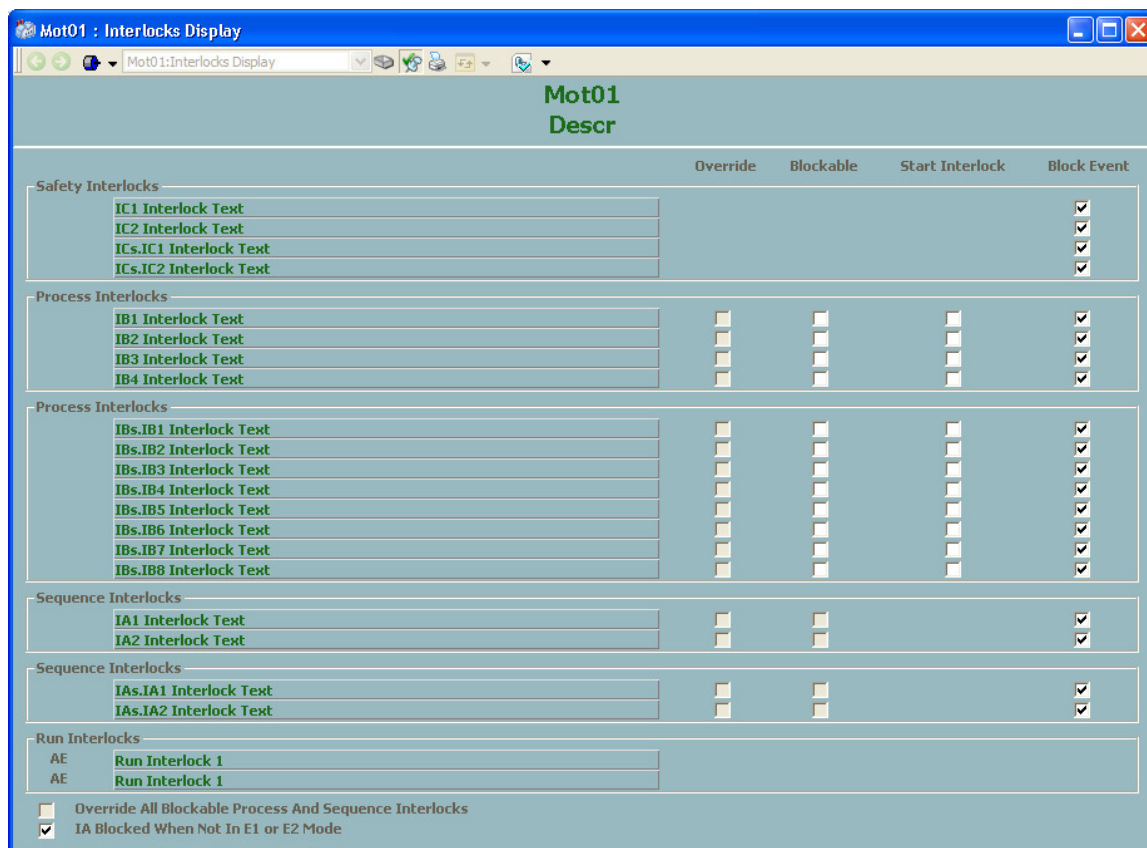
Figure 5-2 Process Display Element.

### 6.1.1.3 Interlock Display

This display shows the actual status of all Interlock. The operator can override individual interlocks or all interlock.

Interlocks that can be overridden must be set to Blockable. This can be done from this display if the user has permission Configure or from the Interaction Window see chapter

Start Interlock, Block Event and IA Blocked when no in E1 or E2 mode are parameters that can be set from this display if the user has Permission Configure or from Interaction Window.



#### 6.1.1.4 Time logged Properties

Measured values stored can be presented graphically in the form of curves on the display screen. Such a display, a trend display, can consist of 1-4 curves. All properties for the object MOTFREQ01 are available to be logged on the trend curves.

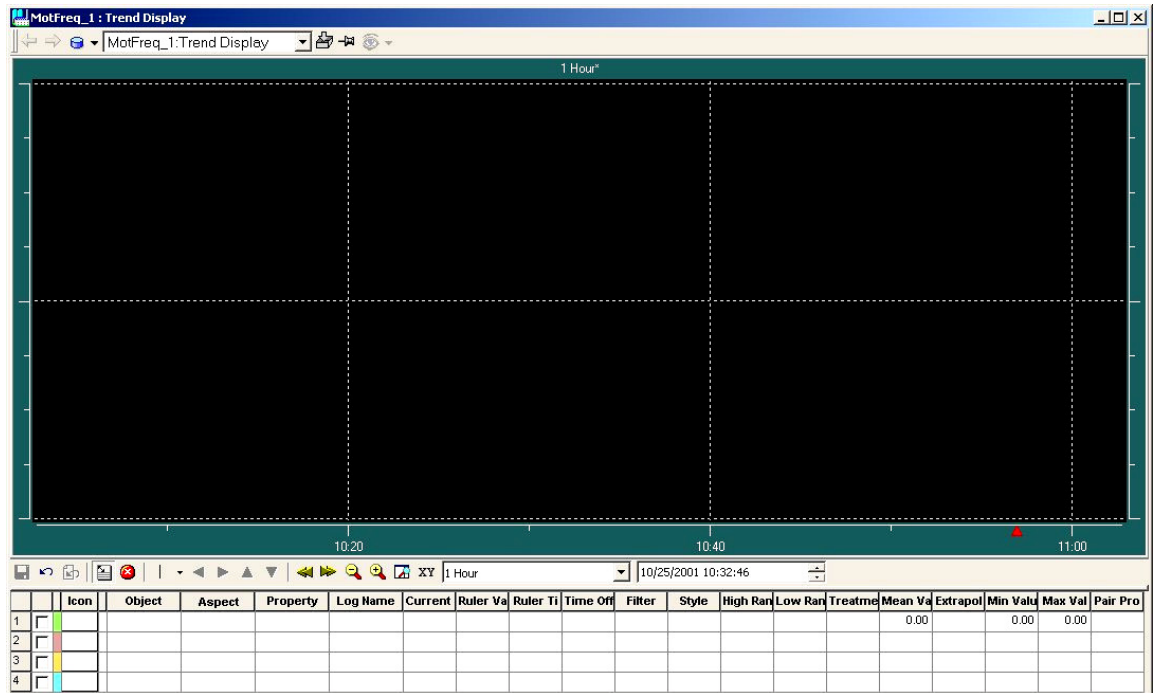


Figure 5-3 Trend Display

## 6.2 Faceplate (Dialog)

The display screen is supplemented with a mouse and keyboard for operator communication with the functional unit/object.

By using OperateIT the operator can view and control the process through faceplates. The dialogue consists of buttons, indicators and graphic presentations within a Faceplate. A faceplate has three levels of dialogue which are presented by the following three runtime views:

- Reduced Faceplate, where the size and contents typically have been optimized to cover most of the normal process operator actions. Minimum dialogue.
- Faceplate, which typically covers all normal process operator actions.
- Extended Faceplate, with functions and information intended for the process engineer or the advanced operator. Maximum dialogue

The figures 5-4 to 5-12 below and overleaf illustrate the various presentations of the faceplate.

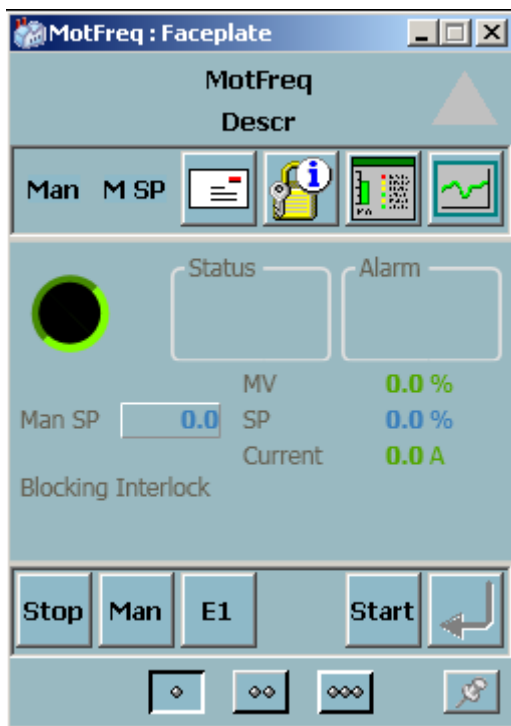


Figure 5-4 Reduced Faceplate

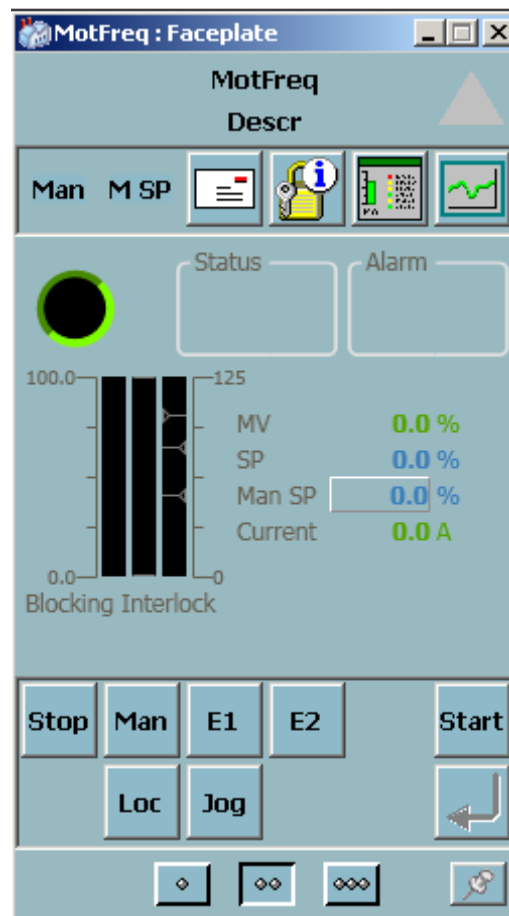


Figure 5-5 Faceplate

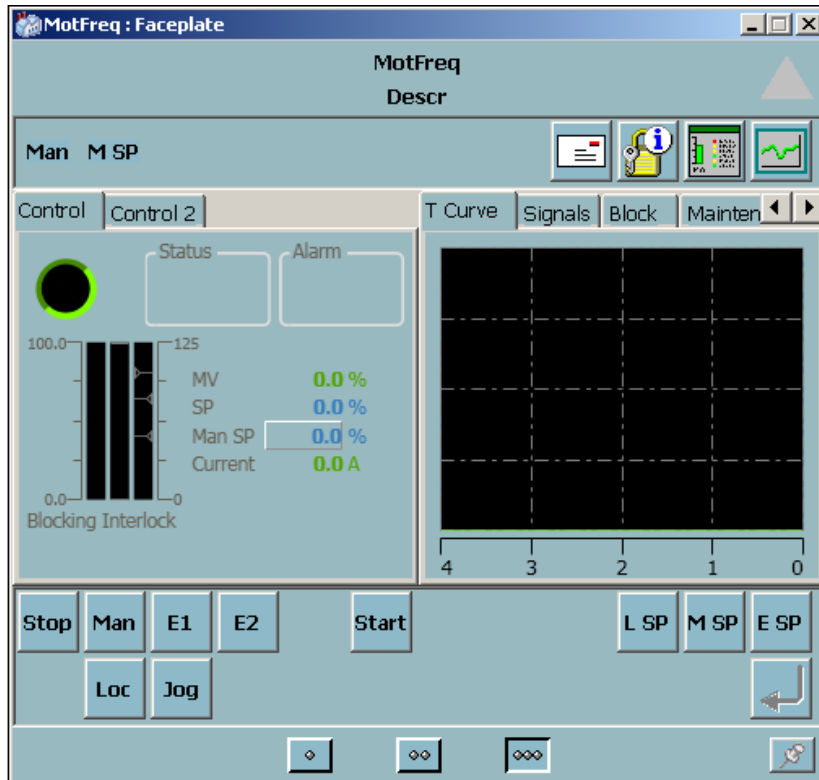


Figure 5-6 Extended Faceplate

## 6.3 Alarm and Event Handling

### 6.3.1 General

This section contains a description of all alarms and events in the functional unit MOT01.

When a motor fails an alarm and an event is generated and can be viewed on the Operate<sup>IT</sup> Operator Station. The alarms are indicated in the faceplate, object display and in the alarm and event list.

The possibilities of the operator to block alarms are shown under the heading 'Event and alarm blocking' below.

The alarm handling for MOTFREQ01 can be controlled individually for the different types of fault, which can develop. See section 4.14 describing the Interaction Window. Note, that the Function Block itself blocks certain alarms in a number of situations. For example RunInt1 and RunInt2 are blocked with the motor at standstill.

Process interlocks do not appear on the alarm and event lists.

The time stamping of the alarm is done when the function block is executed.

Event Time	Object Name	Object Description	Condition	Message Description
02-05-24 03:46:16:763	264M500.RUN	Pulp Mixer Running	Status	Alarm
02-05-24 01:13:04:785	192.168.0.51-0.11.5		HWError	For info see 'Errors and
02-05-24 00:22:18:784	192.168.0.51-0.11.4		HWError	For info see 'Errors and
02-05-23 23:32:31:458	500F1920	Washing Pulp Flow	AI_Err	Alarm
02-05-23 23:32:31:458	500F1920	Washing Pulp Flow	MV_L1	Alarm
02-05-23 23:32:31:458	500F1920	Washing Pulp Flow	MV_L2	Alarm
02-05-23 23:23:01:784	192.168.0.51-0.11.3		HWError	For info see 'Errors and
02-05-23 20:00:07:762	500F1920	Washing Pulp Flow	MV_L2	Alarm
02-05-23 01:38:52:762	500F1920	Washing Pulp Flow	MV_L1	Alarm
02-05-23 00:18:26:995	500F1920	Washing Pulp Flow	AI_Err	Alarm
02-05-22 00:10:00:709	Mot01	Test Mot01	ControlV	Alarm
02-05-20 17:32:45:784	192.168.0.51-0.11.2		HWError	For info see 'Errors and

Figure 5-7 Alarm List

### 6.3.2 Alarm and Event Message

The following alarm texts are generated by the functional unit MOTFREQ01.

The “Condition” text are stored in the Alarm and Event Translator aspect and can be NLS handled.

Object Name	Object Description	Condition	Message Description
<Name>	<Description>	Bearing Temperature	Alarm
<Name>	<Description>	Emergency stop	Fault
<Name>	<Description>	High Current	Alarm
<Name>	<Description>	Inverter Fault	Fault
<Name>	<Description>	Inverter Not Ready	Fault
<Name>	<Description>	MCC fault	Fault
<Name>	<Description>	Main Contactor	Fault
<Name>	<Description>	Run Interlock 1	Run1 Text from Interaction Window
<Name>	<Description>	Run Interlock 2	Run1 Text from Interaction Window
<Name>	<Description>	Motor Temperature	Alarm
<Name>	<Description>	Short Circuit	Fault

The following Event texts are generated by the functional unit MOTFREQ01.

The “Message Description” text are stored in the Alarm and Event Translator aspect and can be NLS handled.

\* ) Ext Start/Stop is a combination of all Start/Stop orders from Application.

SourceName	ObjectDescription	Condition	Message Description
<Name>	<Description>		SeqE1 Mode
<Name>	<Description>		SeqE2 Mode
<Name>	<Description>		SeqMan Mode
<Name>	<Description>		Local Mode
<Name>	<Description>		SeqManSp
<Name>	<Description>		SeqExtSp
<Name>	<Description>		Ext Start *)
<Name>	<Description>		Ext Stop *)
<Name>	<Description>		IC1 On
<Name>	<Description>		IC1 Off
<Name>	<Description>		IC2 On
<Name>	<Description>		IC2 Off
<Name>	<Description>		IB1 On
<Name>	<Description>		IB1 Off
<Name>	<Description>		IB2 On
<Name>	<Description>		IB2 Off
<Name>	<Description>		IB3 On
<Name>	<Description>		IB3 Off
<Name>	<Description>		IB4 On
<Name>	<Description>		IB4 Off
<Name>	<Description>		IA1 On
<Name>	<Description>		IA1 Off
<Name>	<Description>		IA2 On
<Name>	<Description>		IA2 Off
<Name>	<Description>		Run On
<Name>	<Description>		Run Off
<Name>	<Description>		Alarm Acknowledge
<Name>	<Description>		Alarm Control Block

## 6.4 Faceplate Tabs

### 6.4.1 Alarm and Event blocking

By using the faceplate it is possible for the process engineer to block alarms. When the block alarm check box is active then all alarms are blocked as indicated by the yellow characters “B” in the signals faceplate element.

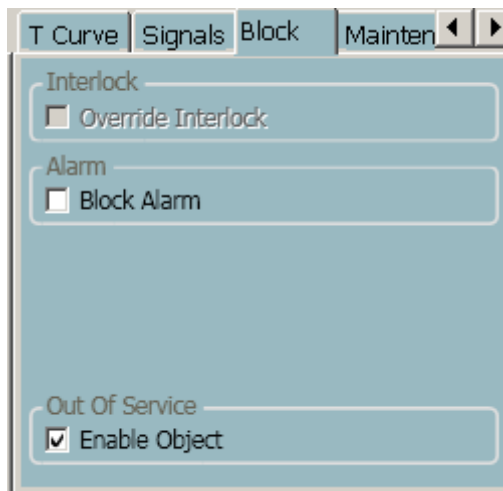


Figure 5-8 Extended Faceplate Element (Block)

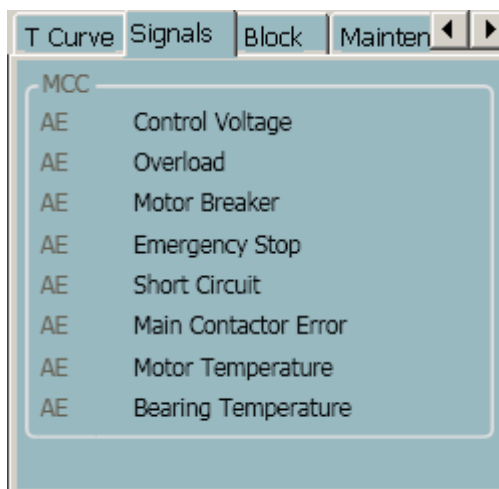


Figure 5-9 Extended Faceplate Element (Signals)

#### 6.4.2 Info Tab

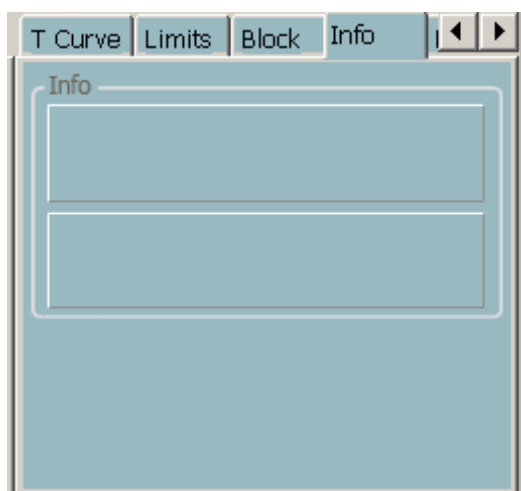


Figure 5-12 Extended Faceplate Info

#### 6.4.3 Maintenance tab



Figure 5-13 Extended Faceplate Maintenance

REVISION

Rev.	Page (P) Chapt. (C)	Description	Date Dept./Init.
-		First Released Version	011102/ FM
A		Rev 1.3/0	021106/MP
B		Rev 2.0	030317/MP
C	5, 8	Initialization	04-04-15/FM
D	3, 4	Rev 3.1/2	050319/MP
E	4,5	Event Handling is added. Interaction Window and Faceplate elements are updated	050329/BP
F	3	Rev 4.0/1	050706/MP
G	1	Rev 4.0/2	060131/MP
H	3,4.1.3,4.3.1	Rev 4.0/2	060506/BP
I	4.10	Rev 4.0/5	070510/BP
J		Rev 5.0-1 Interlock functionality is updated	081204/BP