ENGINEERING TOMORROW

Programming Guide

VLT® Condition-based Monitoring

VLT® FC Series

vlt-drives.danfoss.com

Contents

1 Before you begin

1.1 Introduction to the Programming Guide

Introduction

This chapter describes the purpose of the programming guide, intended audience, disclaimer, safety conventions and additional resources.

Purpose of this Programming Guide

This programming guide provides information on working with Condition-based monitoring parameters on the VLT® FC series.

It provides an overview of parameters and value ranges for operating the drive. Installation and operating instructions are not in scope of this programming guide.

Intended Audience

The intended audience of the programming guide is trained personnel, automation engineers and programmers with experience in operating with parameters and basic knowledge of Danfoss AC drives.

Safety Symbols

The following symbols are used in this manual:

⚠ D A N G E R ⚠

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ W A R N I N G ⚠

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ C A U T I O N ⚠

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

N O T I C E

Indicates information considered important, but not hazard-related (for example, messages relating to property damage).

Additional Resources

Additional resources are available to help you understand related information.

Technical documentation for various product options is available via the Danfoss home page in the Service and Support/Documentation section.

1.2 Reading the parameter table

This programming guide includes parameter and options tables. These descriptions explain how to read the parameter and options tables.

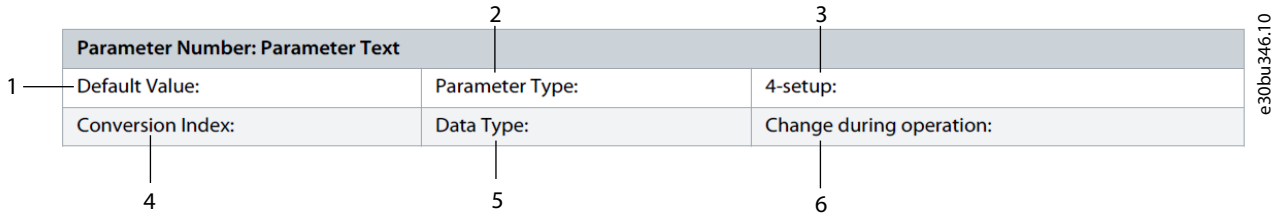


Illustration 1: Parameter Table

1 indicates the value set in factory.

2 indicates whether the parameter type is option or range.

3 indicates the manner of parameter set-ups. *All setups* means that the parameter can be set individually in each of the 4 setups. For example, 1 single parameter can have 4 different data values. *1 setup* indicates that the data value is the same in all setups.

4 refers to the conversion index. Parameter values are transferred as whole numbers only. Conversion factors are therefore used to transfer decimals. If a value is transferred as 100 and a conversion index of -1, the real value is 10.0.

5 indicates the different data types for the parameters.

6 indicates whether the parameter value can be changed while the frequency converter is in operation. False indicates that the frequency converter must be stopped before a change can be made.

Table 1: Conversion Table

Conversion index	Conversion factor
100	1
75	3600000
74	3600
70	60
67	1/60
6	1000000
5	100000
4	10000
3	1000
2	100
1	10
0	1
-1	0.1
-2	0.01
-3	0.001
-4	0.0001
-5	0.00001
-6	0.000001

Table 2: Data type

Data type	Description	Type
2	Integer 8	Int8
3	Integer 16	Int16
4	Integer 32	Int32
5	Unsigned 8	Uint8
6	Unsigned 16	Uint16
7	Unsigned 32	Uint32
9	Visible string	VisStr
33	Normalized value 2 bytes	N2
35	Bit sequence of 16 boolean variables	V2
54	Time difference w/o date	TimD

2 Introduction to Condition-based monitoring

2.1 System Requirements and Compatibility

In order to enable Condition-based monitoring and effectively function, verify the following software compatibilty and system-requirements.

VLT® Products and Software compatibility for Condition-based monitoring

VLT® Product	Minimum Software Compatibility Version
VLT® HVAC Drive FC 102	5.70
VLT® Refrigeration Drive FC 103	2.70
VLT® AQUA Drive FC 202	3.80
VLT® Automation Drive FC 302	8.60
VLT® Motion Control Tool MCT 10	5.11

Control card compatibility for Condition-based monitoring

Control card version	Compatibility	Identification of control card version
MKII	Yes	White USB
MKI	No	Black USB

MKII control card is required to enable license code functions.

Contact local Danfoss Sales partner to determine the possibility of upgrading VLT® product with new control card, inorder to activate license code.

Stator Winding Monitoring Compatibilities

Control mode	Compatibility
VVC+	Yes
U/f	No
Flux	No

Motor type	Compatibility
Asynchronous	Yes
PM, non salient SPM[1]	No
PM, salient IPM[1]	No
SynRM	No
PMaSynRM	No

[1] Ongoing implementation

Filters for stator winding monitoring function

Table 3: Compatible Filters for stator winding function

Filter name	Compatibility	Description
VLT® dU/dt Filter MCC 102	Yes	Baseline needs to be run with the filter. When the filter is installed later, make sure a new baseline is generated.
VLT® Sine-Wave Filter MCC 101	Yes	
VLT® All-Mode Filter MCC 201	Yes	

Sensor Configurations and Additional Analog Inputs

Condition-based programming use external sensors to obtain data. These external sensors are connected to AC Drive via Analog Inputs (AI).

By default, the software enables the use of 2 sensors which is used for vibration monitoring in 2 directions. The software also allows the addition of more sensors. Contact your local sales office for more information.

To facilitate the addition of more sensors or when embedded analog inputs are used, configure the following options to extend the analog inputs.

Table 4: Options and Analog Input Configurations

Option type	Number of AI	Name of AI on the board
VLT® General Purpose I/O MCB 101	2	30/11, 30/12
VLT® Analog I/O MCB109	3	42/1, 42/3, 42/5
VLT® Sensor Input MCB 114	1	48/2
VLT(R) Programmable I/O MCB 115	3	X49/7+8, X49/9+10, X49/11+12

Fieldbus support in Condition-based Monitoring

Table 5: Fieldbus and Product Compatibility for Condition-based Monitoring

Option name	Status of Condition-based monitoring support	Slot	FC 102	FC 103	FC 202	FC 302	FCD 302
Modbus RTU	Yes	RS485	x	x	x	x	x
BACNet MS/TP	No	RS485	x	-	-	-	-
Metasys N2	Yes	RS485	x	-	-	-	-
VLT® Profibus DP MCA 101	Yes, with basic PDC value exchange.	A	x	x	x	x	x
VLT® Devicenet MCA 104	Yes, with basic PDC value exchange.	A	x	-	x	x	-
VLT® CANOpen MCA 105	Yes, with basic PDC value exchange.	A	-	-	-	x	-
AK-LonWorks MCA 107 for ADAP-Kool	No	A	-	x	-	-	-
LonWorks MCA 108	No	A	x	x	-	-	-
VLT® BACNet MCA 109	No	A	x	-	-	-	-
VLT® Profinet MCA 120	Yes, with basic PDC value exchange.	A	x	x	x	x	x
VLT® Ethernet/IP MCA 121	Yes	A	x	-	x	x	x
VLT® Modbus TCP MCA 122	Yes	A	x	-	x	x	x
VLT® POWERLINK MCA 123	No	A	-	-	-	x	x
VLT® EtherCAT MCA 124	Yes	A	-	-	-	x	x
VLT® BACNet/IP MCA 125	Yes	A	x	-	-	-	-

In the above table:

- x indicates the VLT® product supports the fieldbus protocol.
- - indicates the VLT® product does not support the fieldbus protocol.

For more information on fieldbus integration with condition-based monitoring, see 5 Fieldbus Integration for Condition-based Monitoring

For more information on the slots, see the VLT® product design guide

2.2 Ordering Condition-based Monitoring in drives

Condition-based monitoring can be activated from the factory when ordering a new drive. The user can also activate condition-based monitoring on existing VLT product using a license code.

When a license code is activated, parameters in parameter groups 45-**, 46-**, and 47-** reflect the acceptance of license code. These parameters are visible in LCP, MCT-10 or field bus when license code is activated. For further information on specific license codes for each VLT product, refer to Selection Guide.

Identifying License code information

Using the parameter group 15, the user can identify license code information.

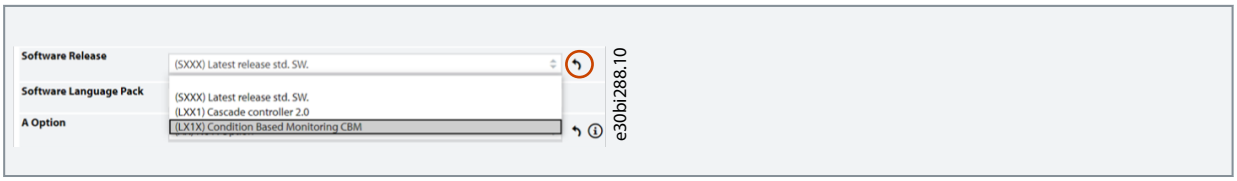
Parameter number and name	License enabled from factory	License activated by customer (retrofit)
Parameter 15-44 Ordered Typecode String	LX1X	SXXX
Parameter 15-45 Actual Typecode String	LX1X	LX1X
Parameter 50-00 License Installed	CBM	CBM

2.2.1 Ordering Condition-based monitoring License From Factory

For the license code to be activated from the factory,the information has to be entered during product selection in the configurator.

Procedure

1. Go to Danfoss Drives Configurator.
2. Click the symbol corresponding to *Software Release* to open software release selections.



3. Select *LX1X Condition Based Monitoring CBM*.

2.2.2 Ordering Condition-based Monitoring in Existing VLT Drive Using MCT-10

For retrofit, licenses can be ordered from the regional sales office. See Product Compatibility.

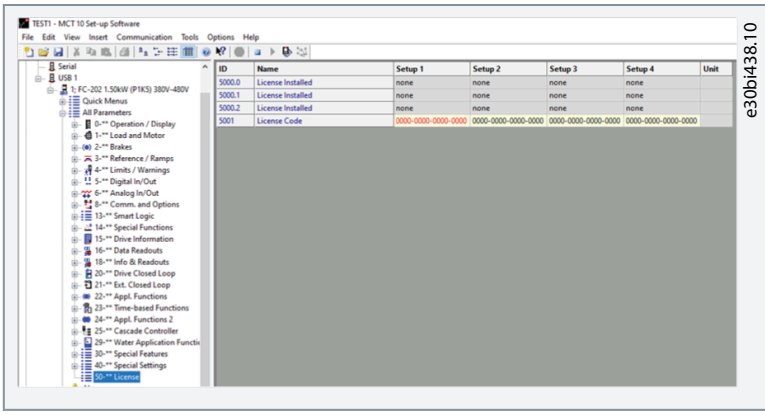
NOTICE

License codes are unique to a single drive. The license code cannot be used on multiple drives.

The license code comprises of 16 alphanumeric characters in the format (XXXX-XXXX-XXXX-XXXX).

Procedure After receiving the license code, perform the following steps:

1. Go to parameter group *50-** License group*.



2. Stop polling. Press the button as shown in the figure.

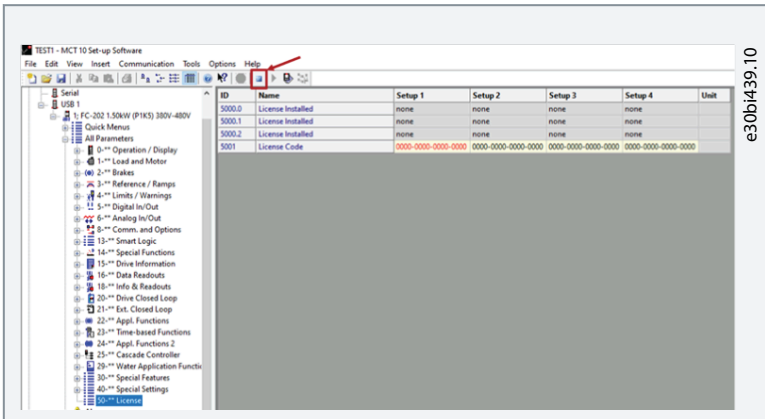
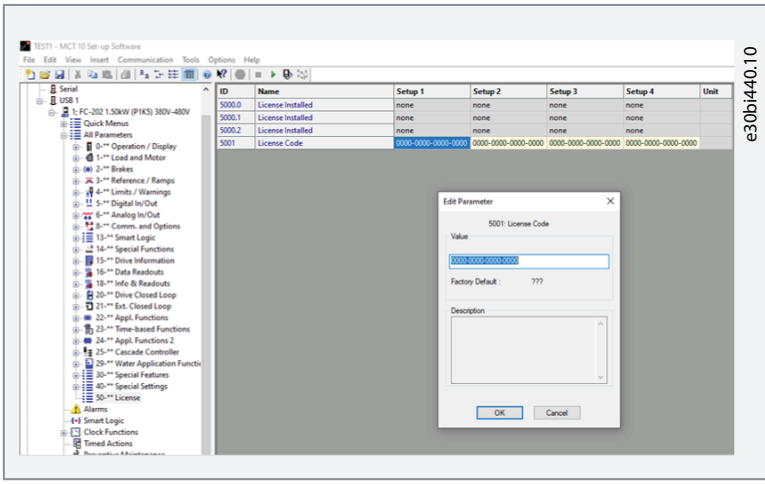
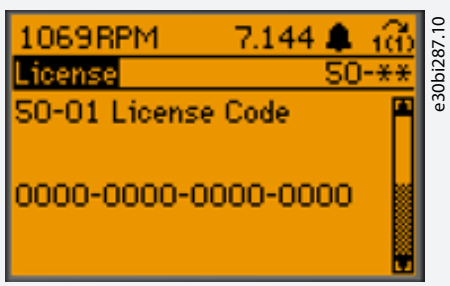


Illustration 2: Stop Polling

3. Go to *parameter 50-01 License Code* using the LCP or MCT-10.
4. Enter the license code in *parameter 50-01 License Code*, instead of 0000-0000-0000-0000.



After entering the license code using the LCP, *parameter 50-01 License Code* shows the following information.



When the license is accepted by the drive, the LCP displays as shown below.

5. Restart the drive and MCT-10 to activate the features.

The parameter groups 45, 46, and 47 are now available in LCP and in MCT-10.

2.2.3 Enabling Condition-based Monitoring Features

In this recommendation, the scenario considered is to enable condition-based monitoring, when one sensor is installed on the drive.

Procedure

1. Go to Parameter Group *45 -** Condition-based Monitoring*.
2. Set the values to raise warnings for condition-based monitoring features, as described in the table.

ID	Name	Value	Description
45-00.0	Function	[1] Warning	Set the value for enabling stator monitoring.
45-00.1	Function	[1] Warning	Set the value for enabling load envelope.
45-00.2	Function	[1] Warning	Set the option for enabling vibration monitoring sensor 1.
45-00.3	Function	[0] Off	Set the option for enabling vibration monitoring sensor 2.

N O T I C E

Make sure to configure *parameter 45-00 Function* inorder to generate [1] Warnings or [2] Warnings & Alarms, for proper functioning of condition-based monitoring features.

- The recommendation is to set *[1] Warnings* in *parameter 45-00 Function*. Setting *[2] Warnings & Alarms* in the parameter can cause the AC drive to trip, as alarms stops the drive.

2.3 Overview on Condition-based Monitoring

Condition-based monitoring in Danfoss VLT® drives enables to regularly check the condition and performance of the machine when the drive is in service, and detects potential mechanical, motor, or application failures before the occurrence of an actual failure.

Benefits of installing the condition-based monitoring firmware are as follows:

- Reduces unexpected downtime
- Eliminates unexpected halts in production
- Optimizes maintenance
- Reduction of spare part stock inventory
- Optimizes production processes

Condition-based monitoring functions

Following are the 3 functions introduced in Condition-based monitoring. All the functions can be enabled at the same time for monitoring the drive.

- **Motor stator winding monitoring:** For this type of monitoring capability, an additional equipment is not required. The motor current signature (inter-turn short circuit or unbalance in motor winding) is detected in drive. Damages caused by motor stator

winding isolation occurs over a period of time. When more winding turns are impacted, the overcurrent protection is activated due to extensive heating and stops the motor

- **Load envelope:** For this type of monitoring capability, an additional equipment is not required. Mechanical load of an application is monitored by comparing current load curve with expected load curve based on data gathered during commissioning. During monitoring, overload and under-load deviations, which occur in applications, are detected.
- **Vibration monitoring:** For this type of monitoring capability, the installation of vibration sensor(s) is required. Speed related vibration (RMS) monitoring via external vibration sensor, detecting early signs of motor misalignments.

N O T I C E

ISO10816 standard provides guidance for evaluating vibration severity for machines operating within 10–200 Hz of frequency range. The standard shall be complied with before commissioning of vibration monitoring function.

2.4 Condition-based Monitoring Workflow

Before starting the commissioning of condition-based monitoring, make sure that the system is configured (installed and commissioned) for normal operation of the drive.

Depending on the user's requirement, commissioning condition-based monitoring allows the possibility to configure thresholds before or after initiating the baseline measurement. The process of obtaining baseline measurements after initiation takes upto 6 months.

The following illustration depicts the two ways to commission condition-based monitoring in a drive.

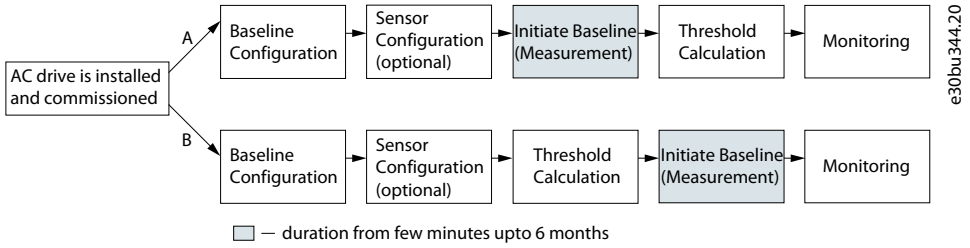


Illustration 3: Condition-based Monitoring Workflow Overview

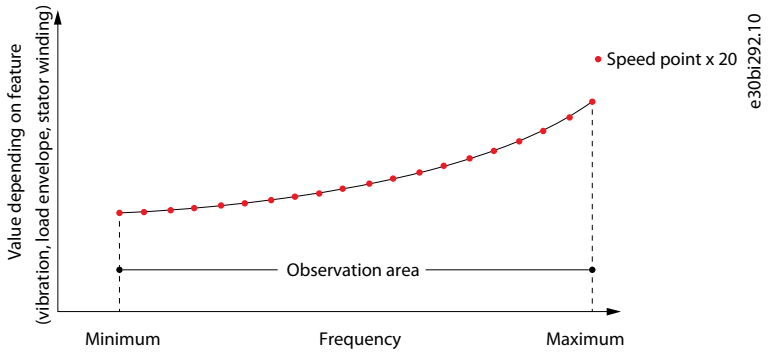
2.4.1 Step 1: Baseline Configuration

Baseline configuration is the **1st step** and essential when commissioning a drive for condition-based monitoring. A baseline signature is required to determine any deterioration in the stator winding, load operating point, or vibration level of the application. The baseline is recorded for each of the activated condition-based monitoring functions.

Following are the different ways to configure baseline:

- **Baseline Run:** The drive takes control of the motor speed and creates a certain configurable speed profile and measures the relevant signals. Depending on the load conditions, it is not always possible to execute the baseline run when the load does not allow.
- **Online Baseline:** In this method, the baseline is created by the drive without interrupting the operation of the drive and application. For the user-specified period of time, the relevant signals are gathered by the drive. This method provides a better representation of normal variation in the application.
- **Manual Baseline:** In this method, the baseline values are manually configured into the drive.This method is relevant when the baseline values are defined using prior experience and the values are configured in the drive.

As illustrated in the graph below, a baseline consists of 20 speed points which are captured based on the user-defined minimum and maximum observation interval.



N O T I C E

For new installations, ISO 20816 recommends a wear-in period before taking a baseline measurement.

2.4.2 Step 2: Sensor Configuration (Optional)

Vibration monitoring requires installation of an external vibration transmitter. The sensor is connected via analog input using for example terminal 53 or terminal 54. When using these terminals make sure to scale correctly. For AI53 S201 to ON = mA and for AI54 switch S202 to ON = mA.

Make sure to configure the correct scaling using parameters in *Parameter Group 6-1* Analog Input 1*.

For example when **terminal AI53** is used, configure the following:

Parameter ID and name	Example Values
Parameter 6-12 Terminal 53 Low Current	4 mA
Parameter 6-13 High Current	20 mA

If these terminals are in use for other equipment, it is possible to extend the analog input with extension options. For information on extension options, see the Selection Guide.

2.4.3 Step 3: Threshold Calculation

Defining or setting the threshold values

In this step, the thresholds are defined. There are 3 methods of threshold calculation.

- **Absolute:** This is the common method when the equipment values are already known. The threshold has a fixed value irrespective of the measured baseline value. For example, when the operator knows the absolute limit for the equipment, an absolute value is set for the alarm threshold. In case of vibration monitoring, the limit values described in standards such as ISO 10816/20816 can be used for the alarm threshold as an absolute value.
- **Offset:** This method of setting threshold values requires understanding of the application and baseline values. The threshold depends on the baseline value to which a user-defined offset is considered in the threshold configuration. Setting a very low or high value leading to false positives is a risk when using this method. False settings can cause irresponsive monitoring, even in the case of faults.
- **Factor:** This method is easier to use when compared to offset, because it does not require in-depth application knowledge. The threshold depends on the baseline value which is multiplied by a factor. For example, the threshold value may be 150% of the baseline. Setting a very high threshold is a risk when using this method of threshold calculation.

2.4.4 Step 4: Alarms and Warnings

In condition-based monitoring, for each feature, the user can define activation stages for warnings and alarms. The interpretation of alarm and warning color codes are as follows:

Green: No alarms are indicated. Condition-based monitoring operations continue.

Yellow: First indication of warning-stage 1 alarm is visible. Stage 1 warning fault are also shown as *Stage 1 Warning (S1)*. Notification to users to plan for maintenance operations. In this stage, condition-based monitoring operations continue.

Orange: Clear indication of warning-stage 2 alarm is visible. Stage 2 warning fault are also shown as *Stage 2 Warning (S2)*. Notification to users to act as soon as possible before the fault becomes critical.

Red: A critical alarm has occurred and condition-based monitoring operations has stopped.

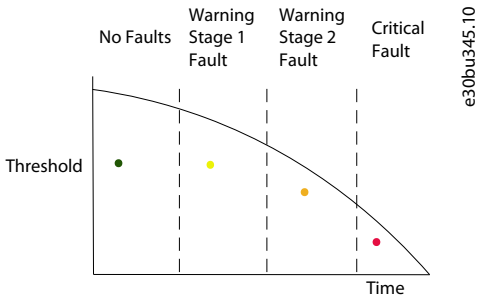


Illustration 4: Alarm and Warning Stages

For more information, see 7.1 Motor Stator Windings, 7.2 Vibration Monitoring, and 7.3 Load Envelope.

3 Examples of Condition-based Monitoring Functions

3.1 Example 1: Motor Stator Winding Monitoring

The AC drive provides variable magnitude of voltage and frequency to the stator terminal of connected 3-phase induction motors. During healthy conditions of the motor with good stator winding insulation between inter-turn, the electrical signature shows consistency on the measurement. The electrical signature repeats the baseline value for repeated measurement.

However, in case of weakened insulation or inter-turn short circuit condition, the electrical signatures deviate from its original baseline values. The function withstands false positive in case of AC mains unbalance.

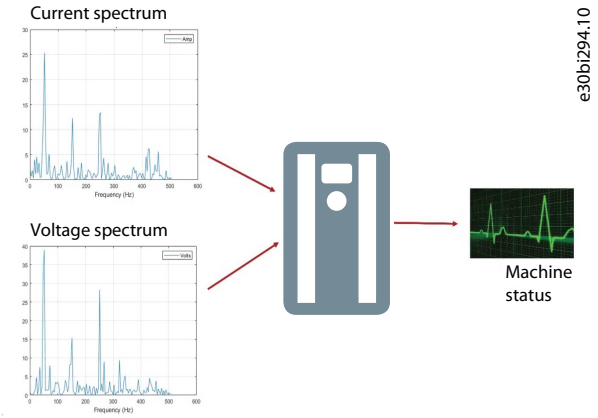


Illustration 5: Example of Motor Stator Winding Monitoring

3.2 Example 2: Load Envelope

The function monitors torque and speed profile of the application which is measured during the baseline measurement. The threshold configuration works similar to the other functions. Condition-based monitoring can detect underload and overload situations. Hence, there are 2 warning stages for high side (overload scenario) and 2 warning stages for underload scenario.

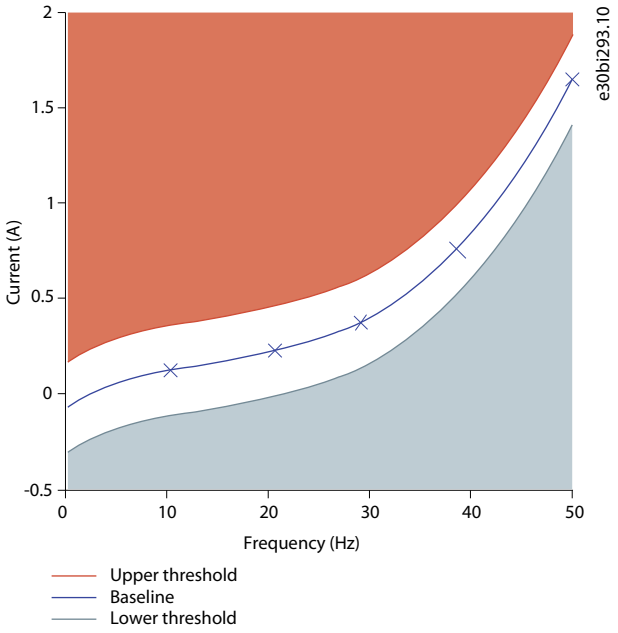


Illustration 6: Load Envelope Example

3.3 Example 3: Vibration Monitoring

The standard ISO 10816/20816 is the recommendation for vibration monitoring. The advantage, VLT® condition-based monitoring provides, is the speed reference to the vibration level instead of an absolute level. The absolute level can mislead in lower levels of the speed reference.

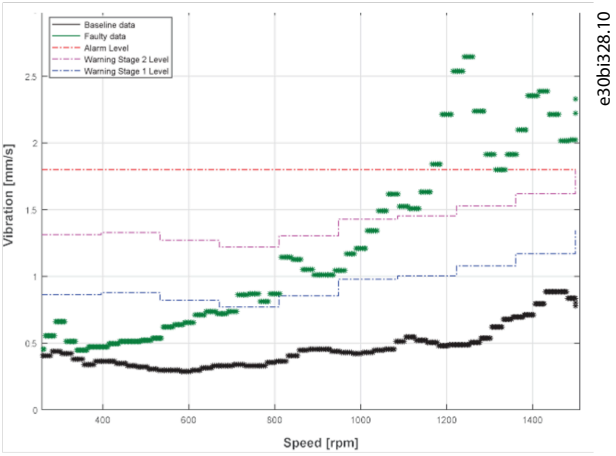


Illustration 7: Vibration Monitoring Example

4 Commissioning of Condition-based Monitoring

4.1 Commissioning Overview

This chapter describes the commissioning of condition-based monitoring from baseline creation to monitoring the system. Before performing commissioning steps, the assumption is the drive is installed and the license code for condition-based monitoring is activated in the drive.

Danfoss Drives recommends to use MCT-10 Condition-based monitoring plug-in for commissioning of condition-based monitoring. It is also possible to perform the commissioning using LCP. The following sections in this chapter, contain the following:

- Commissioning using MCT-10 condition-based monitoring plug-in
- Commissioning using LCP
- Threshold Configuration Guidelines

Based on your MCT-10 version and activated license code, the plug-in is shown below.

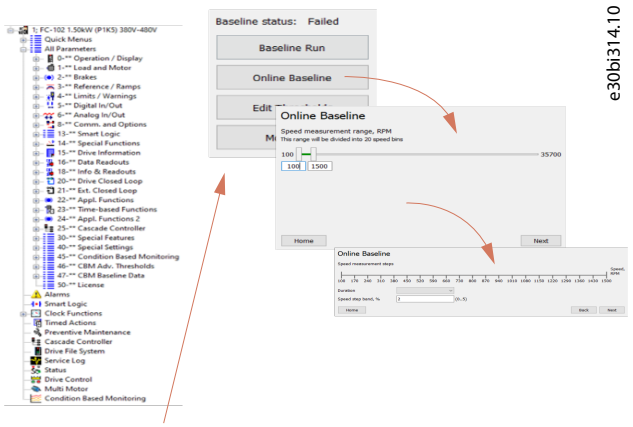


Illustration 8: Condition-based Monitoring Plugin

4.2 Commissioning using MCT-10 Condition-based Monitoring Plug-in

Perform the following steps to set up conditiion-based monitoring in the drive.

- Ensure MCT-10 version 5.11 or later is installed.
- Ensure the desktop or laptop is connected to a powered-on AC drive with activated license code.

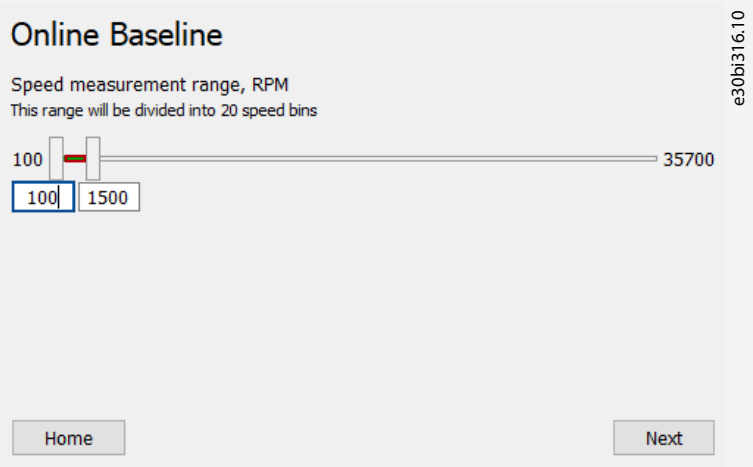
Note: The red highlight in the figure correspond to Danfoss recommended selections, and the blue highlight in the figure correspond to application values. These values can vary based on application.

Procedure: The following are recommended steps to set-up condition-based monitoring:

1. Select *Online Baseline*.

2. Select minimum and maximum speed range using the slider or specify values in the textboxes.

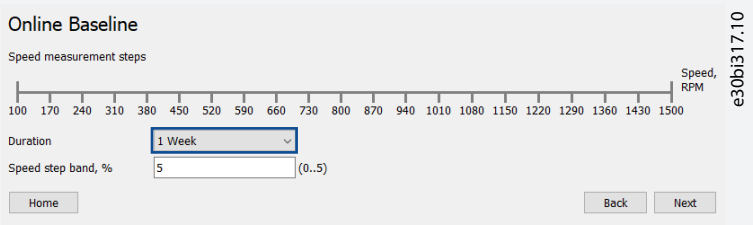
The recommendation is to configure a speed window which relates to motor limitations. The motor speed is configured in *Parameter 4-11 Motor Speed Low Limit [RPM]* and *Parameter 4-13 Motor Speed High Limit [RPM]*.



Note: For advanced baseline settings, the minimum speed can be set as 30% of nominal speed as failures in low speed measurement ranges are difficult to detect.

3. Specify duration to capture baseline in *Duration* field.

It is recommended to specify atleast *1 Week* or more in the *Duration* field.

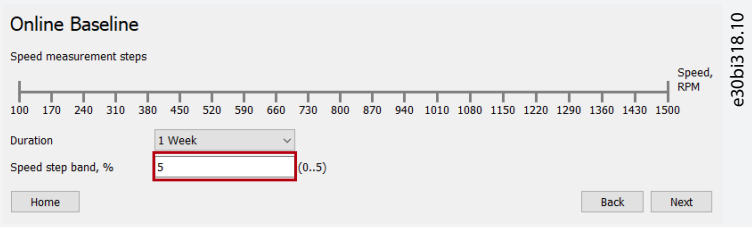


Some of the duration options and corresponding baseline run values are specified below:

Online baseline	Baseline run
2 Hours	1 Minute
4 Hours	2 Minutes
8 Hours	4 Minutes
1 Day	10 Minutes
2 Days	30 Minutes
5 Days	1 Hour
1 Week	2 Hours
2 Weeks	
1 Month	
2 Months	
4 Months	
6 Months	

4. Specify the speed band in the *Speed step band, %* field.

Note: Do not set speed band to 0%. 0% is for niche applications.

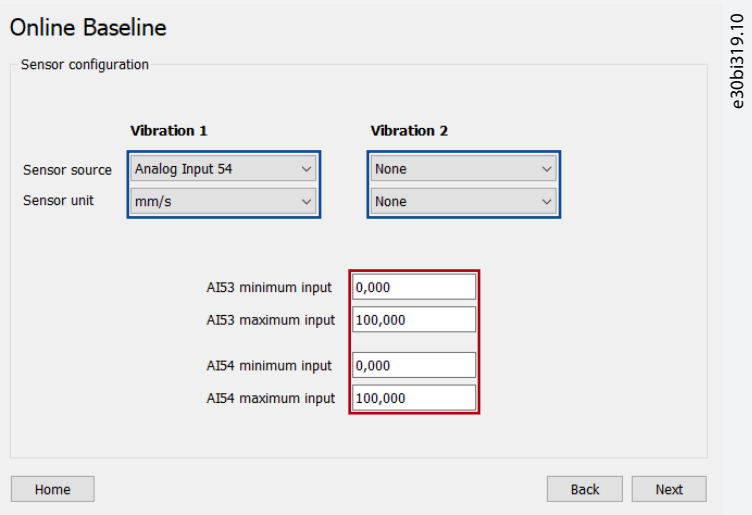


5. Configure vibration sensor information in *Sensor source* and *Sensor unit* fields.

   By default, no value is selected in the fields. If vibration sensors are not configured, press *Next*.

6. Configure the minimum and maximum reference values in *AI53 minimum input*, *AI53 maximum input*, *AI54 minimum input*, and *AI54 maximum input*. Press *Next*.

   The recommended minimum and maximum values are 0 and 100 respectively, providing a reference from 0% to 100%.

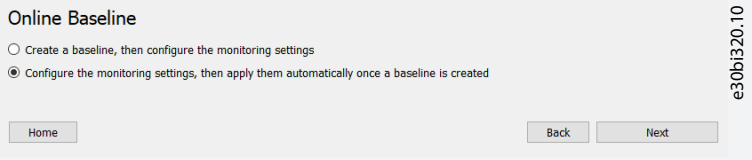


   Make sure to provide the correct scaling either 0-20 mA or 4-20 mA. See Sensor Configuration (Optional).

7. Select an option to set method of baseline configuration. Press *Next*.

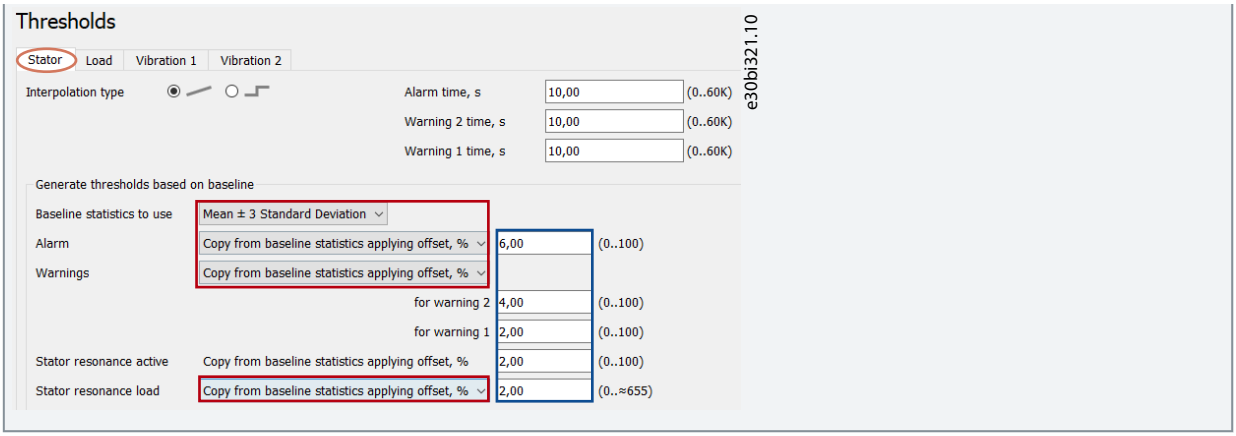
   Note:

   - Duration to finish online baseline execution can occur within a period of 2 hours, 6 months, or one week.
   - Creating a baseline before configuring monitoring settings, requires an additional on-site visit to configure the threshold settings.



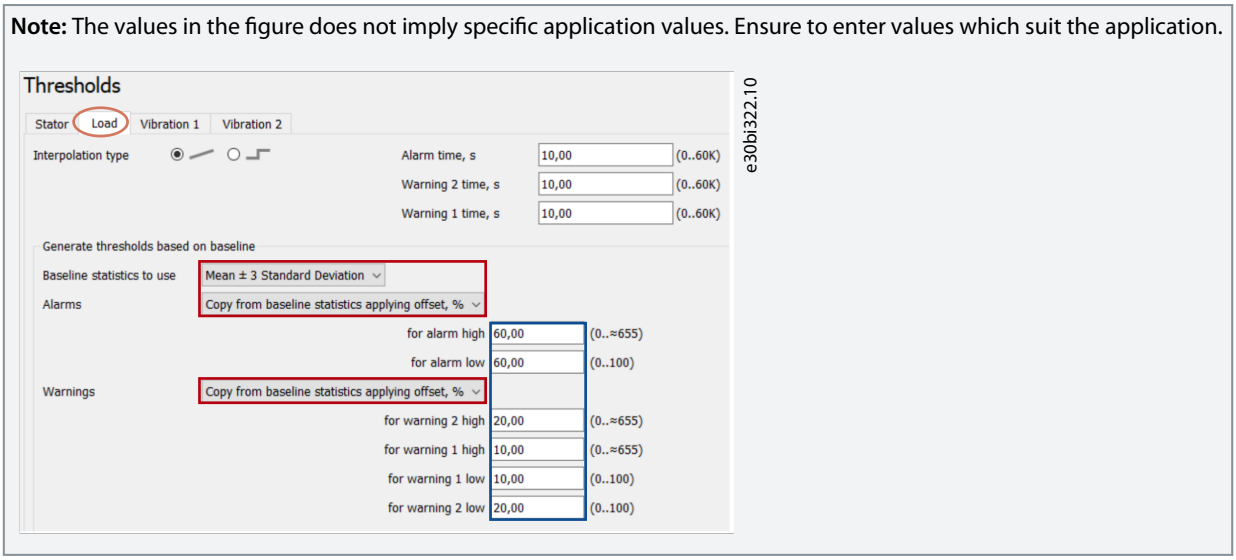
8. To configure stator thresholds, configure settings in *Stator* tab.
9. Select the Danfoss recommended options (highlight in red).
10. Specify application values in *Alarm* and *Warnings* fields (highlight in blue).

    Note: The values in the figure do not imply specific application values. Ensure to enter values which suit the application. Following are the recommended application specific values for monitoring motor stator winding. See 4.4 Threshold Configuration Guidelines.

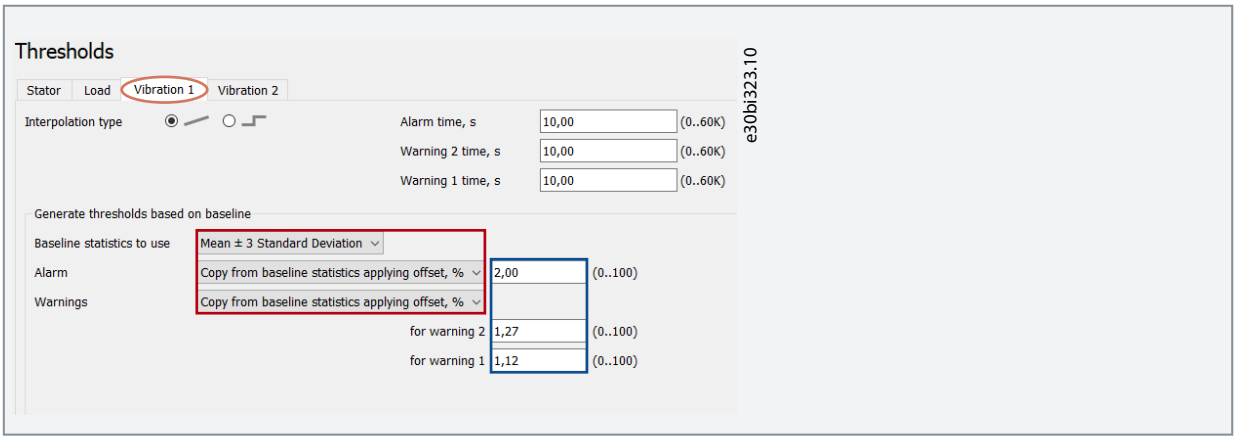


11. To configure load envelope threshold settings, press *Load* tab.
12. Select the Danfoss recommended options (highlight in red).
13. Specify the application-specific values in *Alarms* and *Warnings* fields (highlight in blue).

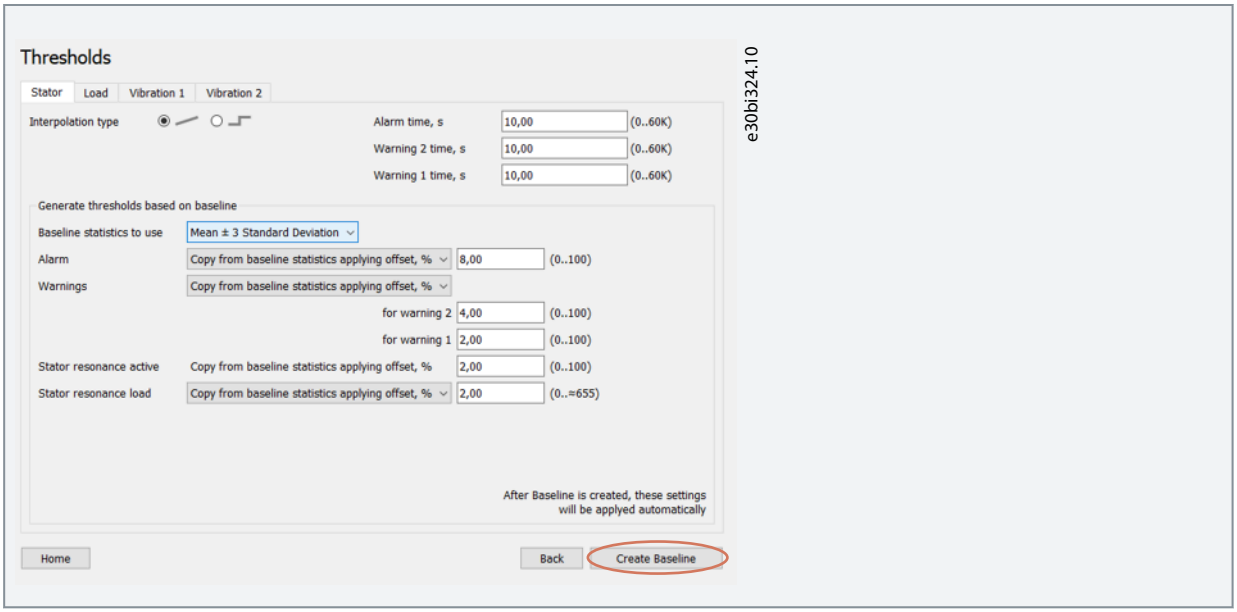
Note: The values in the figure does not imply specific application values. Ensure to enter values which suit the application.



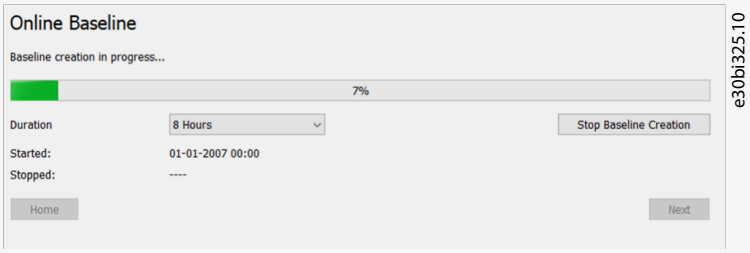
14. To configure vibration monitoring threshold configurations, press*Vibration 1* tab.
15. Select Danfoss recommended options (highlight in red).
16. Specify application specific values in *Alarm* and *Warnings* field (highlight in blue).



17. Click *Create Baseline*.



The progress bar indicates the remaining time for completion.



18. To modify the duration during baseline creation, select required timeline from the *Duration* field.

19. To stop the baseline creation, click *Stop Baseline Creation*.

A timestamp is displayed in *Started* and *Stopped* field, when *parameter 0-70 Date and Time* is configured.

4.3 Recommended Parameter Set-up using LCP or MCT-10

Step 1: Baseline Configuration

ID	Name	Value
Parameter 45-00.0	Function (Stator Winding Monitoring)	Select *[1] Warning* to configure warning for stator winding monitoring.
Parameter 45-00.1	Function (Load Envelope)	Select *[1] Warning* to configure warning for load envelope.
Parameter 45-00.2	Function (Vibration Sensor 1)	Select *[1] Warning* to configure warning for vibration monitoring.
Parameter 45-00.3	Function (Vibration Sensor 2)	Select *[0] Off*to disable warnings or alarms for vibration sensor 2.
Parameter 45-24	Duration	Select *[36] 1 week*. This selection must be based on application.
Parameter 45-25	Online Speed Band	Select *5*. This selection is application specific.
Parameter 45-26	Minimum Speed	Configure the same value as specified in *Parameter 4-11*
Parameter 45-27	Maximum Speed	Configure the same value as specified in *Parameter 4-13*
Parameter 45-20	Type	Select *[2] Online Baseline*.

Result:

- *Parameter 45-21* shows the baseline status.
- *Parameter 45-22* shows the baseline progress.

Step 2: Threshold Configuration for Stator Winding Monitoring

To configure warnings, set *parameter 45-00.0* to *[1] Warning*.

Parameter number	Parameter name	Description and setting
Parameter 45-30.0	Baseline Statistics	Set *[3] Mean +/-3 Standard Deviation*
Parameter 45-31.0	Warning mode	*[1] Offset*
Parameter 45-34.0	Warning S2	• For motor sizes 0 - <22 kW, specify 4.00. • For motor sizes >22kW, specify 2.00
Parameter 45-35.0	Warning S1	• For motor sizes 0 - <22 kW, specify 2.00. • For motor sizes >22kW, specify 1.00
Parameter 46-11.0	Warning S2 time	Specify 10.00
Parameter 46-12.0	Warning S1 time	Specify 10.00
Parameter 45-60	Active Threshold	Specify 0.05
Parameter 45-61	Load Mode	For constant torque, specify *[0] Absolute*. For variable torque, specify *[1] Offset*.
Parameter 46-62	Load Threshold	For constant torque, specify 160. For variable torque, specify 2.

To configure alarms, set *parameter 45-0.0* to *[2] Alarm & Warning*.

Parameter number	Parameter name	Description and setting
Parameter 45-32.0	Alarm Mode	Set *[1] Offset*.

Parameter number	Parameter name	Description and setting
Parameter 45-33.0	Alarm High	• For motor sizes 0 - <22 kW, specify 6.00. • For motor sizes 22kW - <90kW, specify 4.00. • For motor sizes 90KW and above, specify 3.00.
Parameter 46-10.0	Alarm time	Specify 10.00

Step 3: Threshold Configuration for Load Envelope

To configure warnings, set *parameter 45-00.1* to *[1] Warning*. Following are the recommended settings.

Parameter number	Parameter name	Description and setting
Parameter 45-30.1	Baseline Statistics	Set *[3] Mean +/-3 Standard Deviation*
Parameter 45-31.1	Warning mode	[1] Offset
Parameter 45-34.1	Warning S2 High	Specify 30. The value in this parameter is based on the application.
Parameter 45-35.1	Warning S1 High	Specify 20. The value in this parameter is based on the application.
Parameter 45-36.1	Warning S1 Low	Specify 20. The value in this parameter is based on the application.
Parameter 45-37.1	Warning S2 Low	Specify 30. The value in this parameter is based on the application.
Parameter 46-11.1	Warning S2 Time	Specify 10.00.
Parameter 46-12.1	Warning S1 Time	Specify 10.00.
Parameter 46-13.1	Interpolation Type	Specify *[0] Linear*.

To configure alarm, set *parameter 45-00.1* to *[2] Alarm & Warnings*. Following are the recommended settings. When alarms are raised, the system operation is stopped.

Parameter number	Parameter name	Description and setting
Parameter 45-00.1	Function (Load Envelope)	Set *[2] Alarm & Warning*
Parameter 45-32.1	Alarm mode	*[1] Offset*
Parameter 45-33.1	Alarm high	Specify 60.
Parameter 45-38.1	Alarm low	Specify 60.
Parameter 46-10.1	Alarm time	Specify 10.00.

Step 4: Vibration Threshold Configuration

Parameter number	Parameter name	Description and setting
Parameter 45-30.2	Baseline Statistics	Set *[3] Mean+/- Standard Deviation*
Parameter 45-31.2	Warning mode	*[1] Offset*
Parameter 45-34.2	Warning S2 High	Specify 1.52.
Parameter 45-35.2	Warning S1 High	Specify 1.12.
Parameter 46-11.2	Warning S2 time	Specify 10.00.
Parameter 46-12.2	Warning S1 time	Specify 10.00.
Parameter 46-13.2	Interpolation Type	Set *[1] Linear*.

When *parameter 45-00.1* is set to *[2] Alarm & Warnings*, following are the recommended settings. When alarms are raised, the system operation is stopped.

Parameter number	Parameter name	Description and setting
Parameter 45-00.1	Function (Load Envelope)	Set *[2] Alarm & Warning*
Parameter 45-32.1	Alarm mode	[1] Offset
Parameter 45-33.1	Alarm high	Specify 60.
Parameter 45-38.1	Alarm low	Specify 0.
Parameter 46-10.1	Alarm time	Specify 10.00.

4.4 Threshold Configuration Guidelines

Application specific input for monitoring Motor Stator Winding

Following are the recommendation configurations for different motor sizes to monitor motor stator winding.

Parameter	Alarm or Warning	Motor Size < 22kW	Motor Size 22kW to <90 kW	Motor Size 90kW to <355 kW	Motor Size 355kW and higher
Parameter 45-33[0]	Alarm(*)	6.00	4.00	3.00	3.00
Parameter 45-34[0]	Warning 2	4.00	2.00	2.00	2.00
Parameter 45-35[0]	Warning 1	2.00	1.00	1.00	1.00

* By default, the setting should be disabled, as it stops system operation, when the event occurs.

Application specific input for Vibration Monitoring

Following are the recommendation configurations for different motor sizes to monitor motor stator winding.

Table 6: Recommendation for Vibration Monitoring

Zone	Part 3 (Industrial Machines >15kW)				Part 7 (Pumps)				Part 1 (Rest)	
	Rigid		Flexible		Category 1 (critical)		Category 2 (less critical)		Small / Rigid	Large / Flexible
	<300kW	>300kW	<300kW	>300kW	<200kW	>200kW	<200kW	>200kW		
Zone C limit (mm/s)	4.5	7.1	7.1	11	6.6	7.6	8.5	9.5	4.5	14.7
Zone B limit (mm/s)	2.8	4.5	4.5	7.1	4	5	5.1	6.1	1.8	9.3
Zone A limit (mm/s)	1.4	2.3	2.3	3.5	2.5	3.5	3.2	4.2	0.71	4.5
Vibration Warning Offset (mm/2)	0.7	1.125	1.125	1.775	1	1.25	1.275	1.525	0.45	2.325
Off-set % for level 1 Example(1))	2.8	4.5	4.5	7.1	4	5	5.1	6.1	1.8	9.3

1) sensor range 25mm/s

5 Fieldbus Integration for Condition-based Monitoring

5.1 Fieldbus Integration - Options and Parameters

The *parameter 16-03 Status Word* indicates the overall alarm or warning which is triggered due to condition-based monitoring. Specific alarms and warnings are configured using *parameter 16-97 Alarm Word 3* and *parameter 16-98 Warning Word 3*. To make sure that the fieldbus is integrated for viewing the alarms and warnings in condition-based monitoring, configure the following:

Alarm and Warning number with associated bits

The bit for each alarm and warning number is configured in *parameter 18-55 Active Alarm Number*, *parameter 18-56 Active Warning Numbers*, *parameter 16-97 Alarm Word 3*, and *parameter 16-98 Warning Word 3*, as shown in the table. The alarm and warning number is reflected in the LCP.

N O T I C E

Parameter 18-55 Active Alarm Numbers and *Parameter 18-56 Active Warning Numbers* is only available in VLT® Automation Drive FC 302.

Table 7: Bits for configuring alarm and warning number

Alarm or Warning overview	Alarm number (Parameter 18-55)	Warning number (Parameter 18-56)	Alarm Word 3 (Parameter 16-97)	Warning Word 3 (Parameter 16-98)	Description
Stator					
Alarm	510		31		
Warning S2		500		30	
Warning S1		510		31	
Max/min thresholds exceed	520				Configure the bit to show the alarm when maximum or minimum threshold value is exceeded during automatic generation or manual change.
Load Envelope					
Alarm high	511		30		Configure the bit to show load envelope high alarm.
Warning S2 high		501		28	Configure the bit to show load envelope high stage 2 warning.
Warning S1 high		511		29	Configure the bit to show load envelope high stage 1 warning.
Warning S1 low		511		29	Configure the bit to show load envelope low stage 1 warning.
Warning S2 low		501		28	Configure the bit to show load envelope low stage 2 warning.
Alarm Low	511		30		Configure the bit to show low alarm.
Max/min thresholds exceed	521				Configure the bit to show an alarm when the minimum or maximum threshold value is exceeded during automatic generation or manual change.
Sensor 1					
Alarm	512		29		Configure the bit to show an alarm for sensor 1.
Warning S2		502		26	Configure the bit to show a warning stage 2 for sensor 1.

Alarm or Warning overview	Alarm number (Parameter 18-55)	Warning number (Parameter 18-56)	Alarm Word 3 (Parameter 16-97)	Warning Word 3 (Parameter 16-98)	Description
Warning S1		512		27	Configure the bit to show a warning stage 1 for sensor 1.
Max/min thresholds exceed	522				Configure the bit to show an alarm when maximum or minimum threshold values is exceeded during automatic generation or manual change
Sensor 2					
Alarm	513		28		Configure the bit to show an alarm for sensor 2.
Warning S2		503		24	Configure the bit to show a warning stage 2 for sensor 2.
Warning S1		513		25	Configure the bit to show a warning stage 1 for sensor 2.
Max/min thresholds exceed		523			Configure the bit to show a warning when maximum or minimum threshold values exceed during automatic generation or manual change.
Sensor 3					
Alarm	514		27		Configure the bit to show an alarm for sensor 3.
Warning S2		504		22	Configure the bit to show a warning stage 2 for sensor 3.
Warning S1		514		23	Configure the bit to show a warning stage 1 for sensor 3.
Max/min thresholds exceed	524				Configure the bit to show an alarm when maximum or minimum threshold values is exceeded during automatic generation or manual change.
Sensor 4					
Alarm	515		26		Configure the bit to show an alarm for sensor 4.
Warning S2		505		20	Configure the bit to show a warning stage 2 for sensor 4.
Warning S1		515		21	Configure the bit to show a warning stage 1 for sensor 4.
Max/min thresholds exceed		525			Configure the bit to show an alarm when maximum or minimum threshold value is exceeded during automatic generation or manual change.

Alarm and Warning Conversion

In the following table, the conversion for bit, hexadecimal, and decimal are listed for *parameter 16-97 Alarm Word 3* and *parameter 16-98 Warning Word 3*.

Table 8: Alarm and Warning Conversion Table

Bit	Hex	Dec	Alarm Word 3 in *parameter 16-97*	Warning Word 3 in *parameter 16-98*
0	1	1	Temperature input error	Temperature input error
1	2	2	Memory Modele Fault	

Bit	Hex	Dec	Alarm Word 3 in *parameter 16-97*	Warning Word 3 in *parameter 16-98*
2	4	4	Internal Fan Error	Internal Fan Warning
3	8	8	Sync. Fault	
4	10	16	ORM Fault	
5	20	32		Test MOC Function
6	40	64	Profibus Converter Invalid	Profibus Converter time warning
7	80	128		
8	100	256		
9	200	512		
10	400	1024		
11	800	2048		
12	1000	4096		
13	2000	8192		
14	4000	16384		
15	8000	32768		
16	10000	65536		
17	20000	131072		
18	40000	262144		
19	80000	524288		
20	100000	1048576		Sensor 4 S2
21	200000	2097152		Sensor 4 S1
22	400000	4194304		Sensor 3 S2
23	800000	8388608		Sensor 3 S1
24	1000000	16777216		Sensor 2 S2
25	2000000	33554432		Sensor 2 S1
26	4000000	67108864	CBM Sensor 4 Alarm	Sensor 1 S2
27	8000000	134217728	CBM Sensor 3 Alarm	Sensor 1 S1
28	10000000	268435456	CBM Sensor 2 Alarm	CBM Load Envelope High/Low S2
29	20000000	536870912	CBM Sensor 1 Alarm	CBM Load Envelope High/Low S1
30	40000000	1073741824	CBM Load High/Low Alarm	CBM Motor Stator Winding S2
31	80000000	2147483648	CBM Motor Stator Winding Alarm	CBM Motor Stator Winding S1

PCD Parameters

In the section, the parameters relevant for configuring the different fieldbus options are described. Within the array index of the parameter, make sure to configure the option in order to setup condition-based monitoring via fieldbus.

Table 9: Fieldbus option using *parameter 8-43 PCD Read Configuration*

Parameter 8-43	*Parameter 8-43.0*	*Parameter 8-43.2*	*Parameter 8-43.3*
FC	[1603] Status word	[1697] Alarm Word 3	[1698] Warning Word 3
Modbus RTU			
Metasys N2			

Table 10: Fieldbus option using *parameter 9-16 PCD Read Configuration*

Parameter 9-16	*Parameter 9-16.0*	*Parameter 9-16.2*	*Parameter 9-16.3*
VLT Profibus DP MCA 101	[1603] Status word	[1697] Alarm Word 3	[1698] Warning Word 3
VLT Profinet MCA 120			

Table 11: Fieldbus

Parameter 10-12	*Paramter 10-12.0*	*Paramter 10-12.2*	*Parameter 10-12.3*
VLT Devicenet MCA 104	[1603] Status word	[1697] Alarm Word 3	[1698] Warning Word 3

Table 12: Fieldbus option using *Parameter 10-51 Process Data Config Read*

Parameter 10-51	*Parameter 10-51.0*	*Parameter 10-51.2*	*Parameter 10-51.3*
VLT CANOpen MCA 105	[1603] Status word	[1697] Alarm Word 3	[1698] Warning Word 3

Table 13: Fieldbus option using *Parameter 12-22 Process Data Config Read*

Parameter 12-22	*Parameter 12-22.0*	*Parameter 12-22.2*	*Parameter 12-22.3*
VLT Ethernet/IP MCA 121	[1603] Status word	[1697] Alarm Word 3	[1698] Warning Word 3
VLT Modbus TCP MCA 122			
VLT POWERLINK MCA 123			

6 Parameter Descriptions

6.1 Parameter Group 45 -** Condition-based Monitoring

In this parameter group, you can enable condition-based monitoring, define units, baseline computation, input sources, view baseline status, and progress.

Parameter 45-00: Function

Table 14: Parameter 45-00

45-00: Function		
Default Value:*Off*	Parameter Type: Option	4-setup: *2 setup*
Conversion Index: -	Data Type: Uint8	Change during operation: False

Set type of notification level and to enable monitoring of the drive.

Table 15: Options

Options		
Option	Name	Description
[0]	Off	Notification is disabled.
[1]	Warning	Warning notifications are triggered.
[2]	Alarm & Warning	Both alarm and warning notifications are triggered.

Table 16: Parameter Index

Parameter ID	**Description**
45-00.0	Select the required option to enable stator winding monitoring.
45-00.1	Select the required option to enable load envelope
45-00.2	Select the required option to enable sensor 1 vibration.
45-00.3	Select the requred option to enable sensor 2 vibration.

Parameter 45-01: Status

Default Value: *Off*	Parameter Type: Option	4-setup: *2setup*
Conversion Index: -	Data Type: Uint8	Change during operation: False

Set the parameter to view current monitoring status.

Option	**Name**	**Description**
[0]*	Off	Status is disabled.
[1]	On	Shows current monitoring status.
[2]	Waiting For Baseline	Baseline computation is in progress.

Parameter 45-10: Alarm High Threshold

Table 17: Parameter 45-10

45-10: Alarm High Threshold		
Default Value:*0%*	Parameter Type: Range	4-setup: *All set-up*

45-10: Alarm High Threshold		
Conversion Index: -	Data Type: Uint8	Change during operation: True

Set the maximum threshold limit. The drive triggers a notification when threshold limit is exceeded.

Table 18: Options

Parameter ID	Description
45-10.0	Stator Winding
45-10.1	Stator Winding Active
45-10.2	Stator Winding Load
45-10.3	Load Envelope
45-10.4	Sensor 1 Vibration
45-10.5	Sensor 2 Vibration

Parameter 45-11: Warning S2 High Threshold

Table 19: Parameter 45-11

45-11: Warning S2 High Threshold		
Default Value: 0	Parameter Type: Range [0 - 655.35 %]	4-setup: All setups
Conversion Index:	Data Type: Uint8	Change during operation: True

Set the maximum threshold limit for warning stage 2 for the index. The drive triggers a warning notification when threshold limit is exceeded.

Table 20: Parameter Index

Parameter ID	Description
45-11.0	Stator Winding
45-11.1	Stator Winding Active
45-11.2	Stator Winding Load
45-11.3	Load Envelope
45-11.4	Sensor 1 Vibration
45-11.5	Sensor 2 Vibration

Parameter 45-12: Warning S1 High Threshold

Table 21: Parameter 45-12

45-12: Warning S1 High Threshold		
Default Value: 0	Parameter Type: Range [0 - 655.35 %]	4-setup: All setups
Conversion Index: -2	Data Type: Uint8	Change during operation: True

Set the maximum threshold limit for warning stage 1, in the parameter index. The drive triggers a warning notification when threshold limit is exceeded. Entering a value in the parameter indicates a user specified threshold limit.

Table 22: Parameter Index

Parameter ID	Description
45-12.0	Stator Winding
45-12.1	Stator Winding Active
45-12.2	Stator Winding Load
45-12.3	Load Envelope
45-12.4	Sensor 1 Vibration
45-12.5	Sensor 2 Vibration

Parameter 45-13: Actual Monitor Value

Table 23: Parameter 45-13

45-13: Actual Monitor Value		
Default Value:0%	Parameter Type: N/A	4-setup: All setups
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Shows the current value of selected signal.

Table 24: Parameter Index

Parameter ID	Description
45-13.0	Stator Winding
45-13.1	Stator Winding Active
45-13.2	Stator Winding Load
45-13.3	Load Envelope
45-13.4	Sensor 1 Vibration
45-13.5	Sensor 2 Vibration

Parameter 45-14: Warning S1 Low Threshold

Table 25: Parameter 45-14

45-14: Warning S1 Low Threshold		
Default Value:0%	Parameter Type: Range [0 - 655.35 %]	4-setup: All set up
Conversion Index: -2	Data Type: Uint8	Change during operation: True

Set the minimum threshold limit for warning stage 1 notification in the parameter index. The drive triggers a notification when the actual monitoring value falls below the minimum threshold limit.

Table 26: Parameter Index

Parameter ID	Description
45-14.0	Stator Winding
45-14.1	Stator Winding Active
45-14.2	Stator Winding Load

45-14.3	Load Envelope
45-14.4	Sensor 1 Vibration
45-14.5	Sensor 2 Vibration

Parameter 45-15: Warning S2 Low Threshold

Table 27: Parameter 45-15

45-15: Warning S2 Low Threshold		
Default Value:0%	Parameter Type: Range [0 - 655.35 %]	4-setup: All setups
Conversion Index: -	Data Type: Uint8	Change during operation: True

Set the minimum threshold limit for warning stage 2 notification, in the parameter index. The drive triggers a warning stage 2 notification when the actual monitoring value falls below the threshold limit specified in the parameter.

Table 28: Parameter Index

Parameter ID	**Description**
45-15.0	Stator Winding
45-15.1	Stator Winding Active
45-15.2	Stator Winding Load
45-15.3	Load Envelope
45-15.4	Sensor 1 Vibration
45-15.5	Sensor 2 Vibration

Parameter 45-16: Alarm Low Threshold

Table 29: Parameter 45-16

45-16: Alarm Low Threshold		
Default Value:0	Parameter Type: Range ()	4-setup: All setups
Conversion Index: -	Data Type: Uint16	Change during operation: True

Set the minimum threshold limit, in the parameter index. The drive triggers an alarm notification when the actual falls below the minimum threshold limit.

Table 30: Parameter Index

Parameter ID	**Description**
45-16.0	Stator Winding
45-16.1	Stator Winding Active
45-16.2	Stator Winding Load
45-16.3	Load Envelope
45-16.4	Sensor 1 Vibration
45-16.5	Sensor 2 Vibration

Parameter 45–20: Type

Default Value: *Off*	Parameter Type: Option	4-setup: *All setups*
Conversion Index: -	Data Type: Uint8	Change during operation: True

Use the parameter to select type of baseline computation.

Option	Name	Description
[0]*	Off	Baseline computation type is not set.
[1]	Baseline Run	Select the option when the application can operate from minimum to maximum speed in one sweep. On enabling this option, the condition-based monitoring function sets speed points. On completion of baseline computation, the motor is ramped down to 0. The option can only operate when Hand On mode is set via control panel.
[2]	Online Baseline	Select the option in applications where baseline run cannot be utilized. In this type of baseline computation, the drive is controlled by the application baseline and speed points are recorded and saved during the duration specified in *Parameter 45-24 Duration*. The option can only operate when Auto On mode is set via control panel.

Parameter 45–21: Status

Default Value: *Not Started*	Parameter Type: Option	4-setup: *All setups*
Conversion Index: -	Data Type: Uint16	Change during operation: True

Shows the current status of baseline computation.

Option	Name	Description
[0]*	Not Started	-
[1]	Baseline Run running	-
[2]	Online Baseline running	-
[3]	Baseline Completed	-
[4]	Baseline Failed	-

Parameter 45–22: Progress

Default Value: *0%*	Parameter Type: [0-100%]	4-setup: *All setups*
Conversion Index: -	Data Type: Uint8	Change during operation: True

Shows the progress of baseline computation. 0% indicates that the baseline computation is not started and 100% indicates that baseline computation is completed.

Parameter 45–24: Duration

Default Value: *Size related*	Parameter Type: Option	4-setup: *2 setup*
Conversion Index: -	Data Type: Uint8	Change during operation: False

Select a suitable duration for baseline computation. If a value is not selected, by default, the system considers 2 minutes for baseline run and 1 hour for online baseline.

Option	Name	Description
[0]	1 Min	-
[1]	2 Mins	-

Option	Name	Description
[2]	4 Mins	-
[6]	10 Mins	-
[9]	30 Mins	-
[13]	1 Hour	-
[16]	2 Hours	-
[19]	4 Hours	-
[23]	8 Hours	-
[27]	1 Day	-
[30]	2 Days	-
[33]	5 Days	-
[36]	1 Week	-
[40]	2 Weeks	-
[43]	1 Month	-
[46]	2 Months	-
[49]	4 Months	-
[52]	6 Months	-

Parameter 45–25: Online Speed Band

Default Value: *2%*	Parameter Type: [0–5%]	4-setup: *2 setup*
Conversion Index: 0	Data Type: Uint8	Change during operation: True

Use this parameter to define a window to capture the baseline data for different speed points when the speed of drive is within the specified band percentage. Setting the parameter increases a chance to capture all speed points in online baseline mode.

Parameter 45–26 Min. Speed

Default Value: *Size Related*	Parameter Type: Range [*parameter 4-11* – 3600 RPM]	4-setup: *2 setup*
Conversion Index: 67	Data Type: Uint16	Change during operation: False

Use this parameter to set the minimum speed of the drive to begin condition-based monitoring functions. Ensure to set a value which exceeds the minimum speed limit of motor. The minimum limit of motor speed corresponds to the setting in *parameter 4-11 Motor Speed Low Limit [RPM]*. For more information, refer to VLT® AutomationDrive FC 301/302 Programming Guide.

Parameter 45–27: Max.Speed

Default Value: *Size Related*	Parameter Type: [0 – *parameter* 4-13]	4-setup: *2 setup*
Conversion Index: 67	Data Type: Uint16	Change during operation: False

Use this parameter to set the maximum speed of the drive for condition-based monitoring functions. Setting the minimum and maximum speed defines the speed range for condition-based monitoring functions to perform effectively. Ensure to set a value which does not exceed the maximum limit of motor speed. The maximum limit of motor speed corresponds to the setting in *parameter 4-13 Motor Speed High Limit [RPM]*. For more information, refer to the corresponding VLT® Product Programming Guide.

Parameter 45–28: Speed Points

Default Value: *Size related*	Parameter Type: Range [*parameter 45-26 – parameter 45-27*RPM]	4-setup: *2 setup*

Conversion Index: 67	Data Type: Uint16	Change during operation: False

Shows the baseline speed points calculated within the range defined in *parameter 45-26 Min.Speed* and *parameter 45-27 Max.speed*.

Parameter 45–30: Baseline Statistics

Default Value: *Mean*	Parameter Type: Option	4-setup: *2 setup*
Conversion Index: -	Data Type: Uint8	Change during operation: True

Select type of baseline statistical data for visualizing calculated threshold limits for each parameter index. The calculated threshold is used for monitoring purposes.

Option	Name	Description
[1]*	Mean	Average of the baseline data is shown.
[2]	Maximum/Minimum	Maximum and minimum of the baseline data is shown.
[3]	Mean +/- 3 Standard Deviation	Mean and +/-3 standard deviations of the baseline data is shown.

Table 31: Parameter Index

Parameter ID	Description
45-30.0	Stator Winding
45-30.1	Load Envelope
45-30.2	Sensor 1 Vibration
45-30.3	Sensor 2 Vibration

Parameter 45–31: Warning Mode

Default Value: *Absolute*	Parameter Type: Option	4-setup: *2 setup*
Conversion Index: -	Data Type: Uint8	Change during operation: True

Select a mode to define threshold limit for warnings.

Option	Name	Description
[0]*	Absolute	Absolute value is considered as threshold limit.
[1]	Offset	Calculates threshold as a sum of the computed baseline data and the offset values.
[2]	Factor	Calculates threshold as baseline data * factor.

The values can be specified in *Parameter 45-34 Warning S2 High* , *Parameter 45-35 Warning S1 High*, *Parameter 45-36 Warning S1 Low*, and *Parameter 45-37 Warning S2 Low*. For example, if you select Absolute as the option and an warning S2 low and warning S1 high value as 200 and 300 respectively. The threshold limit for warning stage 2 ranges from 200 to 300.

Table 32: Parameter Index

Parameter ID	Description
45-31.0	Stator Winding
45-31.1	Load Envelope
45-31.2	Sensor 1 Vibration
45-31.3	Sensor 2 Vibration

Parameter 45–32: Alarm Mode

Default Value: *Absolute*	Parameter Type: Option	4-setup: *2 setup*
Conversion Index: -	Data Type: Uint8	Change during operation: True

Select a mode to define the threshold limits for alarms.

Option	Name	Description
[0]*	Absolute	Absolute value is considered as threshold.
[1]	Offset	Calculates threshold as a sum of the computed baseline data and the offset values.
[2]	Factor	Calculates threshold as baseline data * factor.

The values can be specified in *Parameter 45-33 Alarm High* and *Parameter 45-38 Alarm Low*. For example, if you select Absolute and set an alarm low and alarm high value as 200 and 300 respectively. The threshold limit for alarms ranges from 200 to 300.

Table 33: Parameter Index

Parameter ID	Description
45-32.0	Stator Winding
45-32.1	Load Envelope
45-32.2	Sensor 1 Vibration
45-32.3	Sensor 2 Vibration

Parameter 45–33: Alarm High

Default Value: *Size Related*	Parameter Type: Range [0–100%]	4-setup: *2 setup*
Conversion Index: -2	Data Type: Uint8	Change during operation: True

Type the threshold value for high alarm notification. Based on the type of alarm mode selected by the user, a high alarm threshold is calculated.

Table 34: Options

Parameter ID	Description
45-33.0	Stator Winding
45-33.1	Load Envelope
45-33.2	Sensor 1 Vibration
45-33.3	Sensor 2 Vibration

Parameter 45–34: Warning S2 High

Default Value: *Size Related*	Parameter Type: Range [0–100%]	4-setup: *2 setup*
Conversion Index: -2	Data Type: Uint8	Change during operation: True

Type the threshold value for computing a warning S2 high notification. Based on the type of warning mode selected by the user, a warning S2 high threshold is calculated.

Table 35: Options

Parameter ID	Description
45-34.0	Stator Winding

45-34.1	Load Envelope
45-34.2	Sensor 1 Vibration
45-34.3	Sensor 2 Vibration

Parameter 45–35: Warning S1 High

Default Value: *Size Related*	Parameter Type: Range [0–100%]	4-setup: *2 setup*
Conversion Index: -2	Data Type: Uint8	Change during operation: True

Type the threshold value for computing a warning S1 high notification. Based on the type of warning mode selected by the user, a warning S1 high threshold is calculated.

Table 36: Options

Parameter ID	Description
45-35.0	Stator Winding
45-35.1	Load Envelope
45-35.2	Sensor 1 Vibration
45-35.3	Sensor 2 Vibration

Parameter 45–36: Warning S1 Low

Default Value: *Size Related**	Parameter Type: Range [0–100%]	4-setup: *2 setup*
Conversion Index: -2	Data Type: Uint8	Change during operation: True

Type the threshold value for computing a warning S1 low notification. Based on the type of warning mode selected by the user, a warning S1 low threshold is calculated.

Table 37: Options

Parameter ID	Description
45-36.0	Stator Winding
45-36.1	Load Envelope
45-36.2	Sensor 1 Vibration
45-36.3	Sensor 2 Vibration

Parameter 45–37: Warning S2 Low

Default Value: *Size Related*	Parameter Type: Range [0–100%]	4-setup: *2 setup*
Conversion Index: -2	Data Type: Uint8	Change during operation: True

Type the threshold value for computing a warning S2 low notification. Based on the type of warning mode selected by the user, a warning S2 low threshold is calculated.

Table 38: Options

Parameter ID	Description
45-37.0	Stator Winding
45-37.1	Load Envelope

45-37.2	Sensor 1 Vibration
45-37.3	Sensor 2 Vibration

Parameter 45–38: Alarm Low

Default Value: *Size Related*	Parameter Type: Range [0–100%]	4-setup: *2 setup*
Conversion Index: -2	Data Type: Uint8	Change during operation: True

Type the threshold value for computing a low alarm notification. Based on the type of alarm mode selected by the user, a low alarm threshold is calculated.

Table 39: Options

Parameter ID	Description
45-38.0	Stator Winding
45-38.1	Load Envelope
45-38.2	Sensor 1 Vibration
45-38.3	Sensor 2 Vibration

Parameter 45–39: Online Baseline Counter

Default Value: *2*	Parameter Type: Range [0–65535]	4-setup: *2 setup*
Conversion Index: 0	Data Type: Uint8	Change during operation: True

Type the minutes during which monitoring values are captured for a speed point during baseline generation. Speed points are captured for different types of condition-based monitoring during the minutes specified in this parameter.

Table 40: Option

Parameter ID	Description
45-39.0	Stator Winding
45-39.1	Load Envelope
45-39.2	Sensor 1 Vibration
45-39.3	Sensor 2 Vibration

Parameter 45–50: Sensor 1 Source

Default Value: *None*	Parameter Type: Option	4-setup: *2 setup*
Conversion Index: -	Data Type: Uint8	Change during operation: False

Select an analog input source for receiving sensor signals. Scaling of analog inputs is performed as defined in *parameter group 6*. For more information on *parameter group 6*, refer to VLT® Automation Drive FC 301/302 Programming Guide.

Option	Name	Description
[0]*	None	-
[1]	Analog Input 53	-
[2]	Analog Input 54	-
[3]	Analog Input X30/11	-

Option	Name	Description
[4]	Analog Input X30/12	-
[5]	Analog Input X42/1	-
[6]	Analog Input X42/3	-
[7]	Analog Input X42/5	-
[8]	Analog Input X48/2	-

Table 41: Option

Parameter ID	Description
45-50.0	Sensor 1 Vibration
45-50.1	Sensor 2 Vibration

Parameter 45–51: Sensor 1 Unit

Default Value: *mm/s*	Parameter Type: Option	4-setup: *2 setup*
Conversion Index: -	Data Type: Uint8	Change during operation: True

Use the parameter to set unit of monitoring signals from the sensor. The unit is specified on the vibration sensor.

Option	Name	Description
[0]*	mm/s	-
[1]	inch/s	-
[2]	m/s2	-
[3]	g	-

Parameter 45-60: Active Threshold

Table 42: Parameter 45-60 Active Threshold

45-60: Active Threshold		
Default Value: 2*	Parameter Type: Range [0-100%]	4-setup: 2 set-ups
Conversion Index:-2	Data Type: Uint8	Change during operation: True

6.2 Parameter Group 46-** CBM Monitoring Configuration

Parameter 46-09: Monitoring Speeds

Table 43: Parameter 46-09

46-09: Monitoring Speeds		
Default Value: Size Related*	Parameter Type: Range [par 45-46 - par 45-47 RPM]	4-setup: All set up
Conversion Index: 67	Data Type: Uint16	Change during operation: True

This parameter shows the 20 speed points in RPM. By default, the baseline minimum speed is considered.

Parameter 46-10: Alarm Time

Table 44: Parameter 46-10

46-10: Alarm Time		
Default Value: 10s*	Parameter Type: Range [0 - 60000s]	4-setup: All set up
Conversion Index: -2	Data Type: Uint32	Change during operation: True

Set the time in seconds to define duration during which the alarm is not triggered. When the value which is monitored exceeds or falls below the alarm threshold for more than the time specified in the parameter, an alarm is triggered. Alarm time is the amount of time in seconds a monitoring state should be over alarm threshold before triggering an alarm.

Table 45: Parameter Index

Parameter ID	Description
46-10.0	Stator Winding
46-10.1	Load Envelope
46-10.2	Sensor 1 Vibration
46-10.3	Sensor 2 Vibration

Parameter 46-11: Warning S2 Time

Table 46: Parameter 46-11

46-11: Warning S2 Time		
Default Value: 10s*	Parameter Type: Range [0 - 60000s]	4-setup: All set up
Conversion Index: -2	Data Type: Uint32	Change during operation: True

Set the time in seconds to define duration during which the warning S2 is not triggered. When the value which is monitored exceeds or falls below the warning S2 threshold for more than the time specified in the parameter, a warning S2 is triggered.

Table 47: Parameter Index

Parameter ID	Description
46-11.0	Stator Winding
46-11.1	Load Envelope
46-11.2	Sensor 1 Vibration
46-11.3	Sensor 2 Vibration

Parameter 46-12: Warning S1 Time

Table 48: Parameter 46-12

46-12: Warning S1 Time		
Default Value: 10s*	Parameter Type: Range [0 - 60000s]	4-setup: All set up
Conversion Index: -2	Data Type: Uint32	Change during operation: True

Set the time in seconds to define duration during which the warning S1 is not triggered. When the value which is monitored exceeds or falls below the warning S1 threshold for more than the time specified in the parameter, a warning S1 is triggered.

Table 49: Parameter Index

Parameter ID	Description

46-12.0	Stator Winding
46-12.1	Load Envelope
46-12.2	Sensor 1 Vibration
46-12.3	Sensor 2 Vibration

Paramter 46-13: Interpolation Type

Table 50: Parameter 46-13 Interpolation Type

46-13: Interpolation Type		
Default Value:Linear *	Parameter Type: Option	4-setup: 2 set-up
Conversion Index: -	Data Type: Uint8	Change during operation: True

Set the type of interpolation parameter to construct accurate speed points.

Table 51: Index Array

Parameter ID	**Description**
46-13.0	Stator Winding
46-13.1	Load Envelope
46-13.2	Sensor 1 Vibration
46-13.3	Sensor 2 Vibration

Table 52: Options

Options		
Option	Name	Description
[0]*	Linear	Select this option for stator and load monitoring.
[1]	Staircase	Select this option for vibration monitoring.

Parameter 46-20: Alarm High

Table 53: Parameter 46-20

46-20: Alarm High		
Default Value: 0%*	Parameter Type: Range [0 - 200%]	4-setup: All setups
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Set the threshold value which defines a high alarm for stator monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a high alarm is triggered. The parameter contains 20 index values to manually configure Stator Winding Monitoring Alarm High Threshold for each individual speed point.

Parameter 46-21: Warning S2 High

Table 54: Parameter 46-21

46-21: Warning S2 High		
Default Value: 0%*	Parameter Type: Range [0 - 200%]	4-setup: All set up
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Set the threshold value which defines a warning S2 alarm for stator monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in warning S2 time, a high warning S2 is triggered. The parameter contains 20 index values to manually configure Stator Winding Monitoring Warning S2 High Threshold for each individual speed point.

Parameter 46-22: Stator Warning S1 High

Table 55: Parameter 46-22

46-22: Stator Warning S1 High		
Default Value: 0%*	Parameter Type: Range [0 - 200%]	4-setup: All set-ups
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Set the threshold value which defines a high warning S1 for stator monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in warning S1 time, a high warning S1 is triggered. The parameter contains 20 index values which can be used to manually configure Stator Winding Monitoring Warning S1 High Threshold for each individual speed point.

Parameter 46-23: Resonance Active

Table 56: Parameter 46-23

46-23: Resonance Active		
Default Value: 0%*	Parameter Type: Range [0 - 100%]	4-setup: All set-ups
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Parameter 46-24: Resonance Load

Table 57: Parameter 46-24

46-24: Resonance Load		
Default Value: 0%*	Parameter Type: Range [0 - 100%]	4-setup: All set-ups
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Parameter 46-30: Alarm High

Table 58: Parameter 46-30

46-30: Alarm High		
Default Value: 0%*	Parameter Type: Range [0 - 200%]	4-setup: All set up
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Set the threshold value which defines a high alarm for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a high alarm is triggered. The parameter contains 20 index values which can be used to manually configure Load Alarm High Threshold for each individual speed point.

Parameter 46-31: Warning S2 High

Table 59: Parameter 46-31

46-31: Warning S2 High		
Default Value: 0%*	Parameter Type: Range [0 - 200%]	4-setup: All set up
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Set the threshold value which defines a high warning S2 for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in warning S2 time, a warning S2 high is triggered. The parameter contains 20 index values which can be used to manually configure Load Warning S2 High Threshold for each individual speed point.

Parameter 46-32: Warning S1 High

Table 60: Parameter 46-32

46-32: Warning S1 High		
Default Value: 0%*	Parameter Type: Range [0 - 200%]	4-setup: All set up
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Set the threshold value which defines a high warning S1 for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in warning S1 time, a high warning S1 is triggered. The parameter contains 20 index values which can be used to manually configure Load Warning S1 High Threshold for each individual speed point.

Parameter 46-33: Warning S1 Low

Table 61: Parameter 46-33

46-33: Warning S1 Low		
Default Value: 0%*	Parameter Type: Range [0 - 200%]	4-setup: All set up
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Set the threshold value which defines a low S1 warning for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in warning S1 time, a low S1 warning is triggered. The parameter contains 20 index values which can be used to manually configure Load Warning S1 Low Threshold for each individual speed point.

Parameter 46-34: Warning S2 Low

Table 62: Parameter 46-34

46-34: Warning S2 Low		
Default Value: 0%*	Parameter Type: Range [0 - 200%]	4-setup: All set up
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Set the threshold value which defines a low S2 warning for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in warning S2 time, a low S2 warning is triggered. The parameter contains 20 index values which can be used to manually configure Load Warning S2 Low Threshold for each individual speed point.

Parameter 46-35: Alarm Low

Table 63: Parameter 46-35

46-35: Alarm Low		
Default Value: 0%*	Parameter Type: Range [0 - 200%]	4-setup: All set up
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Set the threshold value which defines a low alarm for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a low alarm is triggered. The parameter contains 20 index values which can be used to manually configure Load Alarm Low Threshold for each individual speed point.

Parameter 46-40: Vibration 1 Alarm High

Table 64: Parameter 46-40

46-40: Vibration 1 Alarm High		
Default Value: 0%*	Parameter Type: Range [0 - 200%]	4-setup: All set up
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Set the threshold value which defines a low alarm for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a low alarm is triggered. The parameter

contains 20 index values which can be used to manually configure Vibration 1 Alarm High Threshold for each individual speed point.

Parameter 46-41: Vibration 1 Warning S2 High

Table 65: Parameter 46-41

46-41: Vibration 1 Warning S2High		
Default Value: 0%*	Parameter Type: Range [0 - 200%]	4-setup: All set up
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Set the threshold value which defines a low alarm for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a low alarm is triggered. The parameter contains 20 index values which can be used to manually configure Vibration 1 Warning S2 High Threshold for each individual speed point.

Parameter 46-42: Vibration 1 Warning S1 High

Table 66: Parameter 46-42

46-42: Vibration 1 Warning S1 High		
Default Value: 0%*	Parameter Type: Range [0 - 200%]	4-setup: All set up
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Set the threshold value which defines a low alarm for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a low alarm is triggered. The parameter contains 20 index values which can be used to manually configure Vibration 1 Warning S2 High Threshold for each individual speed point.

Parameter 46-50: Vibration 2 Alarm High

Table 67: Parameter 46-50

46-50: Vibration 2 Alarm High		
Default Value: 0%*	Parameter Type: Range [0 - 200%]	4-setup: All set up
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Set the threshold value which defines a low alarm for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a low alarm is triggered. The parameter contains 20 index values which can be used to manually configure Vibration 2 Alarm High Threshold for each individual speed point.

Parameter 46-51: Vibration 2 Warning S2 High

Table 68: Parameter 46-51

46-51: Vibration 2 Warning S2 High		
Default Value: 0%*	Parameter Type: Range [0 - 200%]	4-setup: All set up
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Set the threshold value which defines a low alarm for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a low alarm is triggered. The parameter contains 20 index values which can be used to manually configure Vibration 2 Warning S2 High Threshold for each individual speed point.

Parameter 46-52: Vibration 2 Warning S1 High

Table 69: Parameter 46-52

46-52: Vibration 2 Warning S1 High		
Default Value: 0%*	Parameter Type: Range [0 - 200%]	4-setup: All set up

46-52: Vibration 2 Warning S1 High		
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Set the threshold value which defines a low alarm for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a low alarm is triggered. The parameter contains 20 index values which can be used to manually configure Vibration 2 Alarm High Threshold for each individual speed point.

6.3 Parameter Group 47 -** CBM Baseline Data

In this parameter group, you can view active and previous condition-based monitoring values.

Parameter 47–04: Active Speed

Default Value:-	Parameter Type: Range [*parameter 45–26– parameter 45–27*RPM]	4-setup: *All setups*
Conversion Index: 67	Data Type: Uint16	Change during operation: True

Shows the current baseline speed and is shown when baseline computation is completed. An index parameter with 20 pointers which shows all minimum to maximum baselines.

Parameter 47-06: Active Max

Default Value:-	Parameter Type: Range [*parameter 45-26 – parameter 45-27* RPM]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Shows the maximum stator winding readings for active baseline.

Parameter 47-07: Active Mean + 3 Std.Dev

Default Value:	Parameter Type: Range [0–100%]	4-setup:
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Shows the mean and three standard deviations of stator winding readings for active baseline.

Parameter 47-08: Active Mean

Default Value:	Parameter Type: Range [0–100%]	4-setup: All setups
Conversion Index: -2	Data Type: Uint16	Change during operation: True

Shows the average of stator winding readings for active baseline.

Parameter 47-09: Active Min

Default Value:	Parameter Type: Range [0–100%]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: True

The parameter shows the minimum value of motor stator windings for active baseline.

Parameter 47–10: Active Counter

Default Value:	Parameter Type: Range [0–65535]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: False

The parameter shows the active minutes to capture monitoring alues for speed points.

Parameter 47–16: Active Max

Default Value:	Parameter Type: Range [0–100%]	4-setup: All setups
Conversion Index: -2	Data Type: Uint16	Change during operation: False

Shows the active stator resistance.

Parameter 47–17: Active Mean + 3 Std. Dev

Default Value: *Size Related*	Parameter Type: Range [0–100%]	4-setup: *2 setup*
Conversion Index: -2	Data Type: Uint8	Change during operation: True

Type the threshold value for high alarm notification. Based on the type of alarm mode selected by the user, a high alarm threshold is calculated.

Table 70: Options

Parameter ID	Description
45-33.0	Stator Winding
45-33.1	Load Envelope
45-33.2	Sensor 1 Vibration
45-33.3	Sensor 2 Vibration

Parameter 47–18: Active Mean

Default Value:	Parameter Type: Range [0–100%]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: False

Shows the mean of stator resistance recordings for active load in active baseline.

Parameter 47–19: Active Min

Default Value:	Parameter Type: Range [0–100%]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: False

Shows the minimum of all stator resistance recordings for active load in active baseline.

Parameter 47–24: Active Max

Default Value:	Parameter Type: Range [0–655%]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: False

Shows the maximum load dependent stator resistance. An indexed parameter with 20 pointers showing stator resistors load recordings from minimum to maximum.

Parameter 47–25: Active Mean + 3 Std. Dev

Default Value:	Parameter Type: Range [0–100%]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: False

Shows the average and standard deviation of stator resistor load recordings for active baseline.

Parameter 47–26: Active Mean

Default Value:	Parameter Type: Range [0–655%]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: False

Shows the average of stator resistor load recordings for active baseline.

Parameter: 47–27 Active Min

Default Value:	Parameter Type: Range [0–655%]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: False

Shows the minimum value of stator resistor load recordings for active baseline.

Parameter: 47–32 Active Max

Default Value:	Parameter Type: Range [0–655%]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: False

Shows the maximum positive load envelope recordings for active baseline. An indexed parameter with 20 pointers of positive load envelope recordings with minimum to maximum.

Parameter: 47–33 Active Mean + 3 Std. Dev.

Default Value:	Parameter Type: Range [0-655%]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: False

Shows the active mean and 3 standard deviation of load envelope recordings for active baseline.

Parameter: 47–34 Active Mean

Default Value:	Parameter Type: Range [0–655%]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: False

Shows the active mean of load envelope recordings for active baseline.

Parameter: 47–35 Act. Mean - 3 Std. Dev

Default Value:	Parameter Type: Range [0–655%]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: False

Shows the active mean and 3 standard deviation of load envelope recordings for active baseline.

Parameter: 47–36 Active Min

Default Value:	Parameter Type: Range [0–655%]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: False

Shows the minimum value of load envelope recordings for active baseline.

Parameter: 47–37 Active Counter

Default Value:	Parameter Type: Range [0–65535]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: False

Parameter: 47–44 Active Max

Default Value:	Parameter Type: Range [0–100%]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: False

Shows the maximum recordings from vibration sensors for active baseline.

Parameter 47-45: Active Mean + 3 Std. Dev

Default Value:	Parameter Type: Range [0–100%]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: False

Shows the average and 3 standard deviations for upper threshold of recordings from vibration sensors for active baseline.

Parameter 47–46: Active Mean

Default Value:	Parameter Type: Range [0-100%]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: False

Shows the average value of recordings from vibration sensors for active baseline.

Parameter 47–47: Active Min

Default Value:	Parameter Type: Range [0–100%]	4-setup: *All setups*
Conversion Index: -2	Data Type: Uint16	Change during operation: False

Shows the minimum value of recordings from vibration sensors for active baseline.

7 Appendix

7.1 Motor Stator Windings

Following are the list of alarms and warnings for motor stator windings.

7.1.1 Alarm 510, Motor Stator Winding Alarm

Cause

Stator winding has reached condition red. Severe fault is detected in motor.

Troubleshooting

- Check motor stator windings.

7.1.2 Warning 510, Motor Stator Winding Warning 1

Cause

Stator winding reached condition yellow. Early fault detected in motor.

Troubleshooting

- Check motor stator windings.

7.1.3 Warning 500, Motor Stator Winding Warning 2

Cause

Stator winding reached condition orange. Severe fault might occur soon in the motor.

Troubleshooting

- Check motor stator windings.

7.2 Vibration Monitoring

Following are the list of alarms and warnings for vibration monitoring.

7.2.1 Alarm 512, Vibration Monitoring Alarm

Cause

Excessive vibration of motor and has reached condition red.

Troubleshooting

- Check root cause for excessive vibration. ISO10816 standard for machinery must be complied with before commissioning of condition-based monitoring.

7.2.2 Warning 512, Vibration Monitoring Warning 1

Cause

Increased vibration of motor is detected. Vibration levels has reached condition yellow.

Troubleshooting

- Check root cause for increased vibration.

7.2.3 Warning 502, Vibration Monitoring Warning 2

Cause

Much increase in vibration of motor is detected. Vibration levels has reached condition orange.

Troubleshooting

- Check root cause for severe vibration.

7.3 Load Envelope

Following are the alarms and warnings for the application's load envelope.

7.3.1 Alarm 511, Load Envelope Alarm

Cause

Application load has reached condition red.

Troubleshooting

- Check root cause for excessive overload or underload.

7.3.2 Warning 511, Load Envelope Warning 1

Cause

Application load has reached condition yellow.

Troubleshooting

- Check root cause for high motor load.

7.3.3 Warning 501, Load Envelope Warning 2

Cause

Application load has reached condition orange.

Troubleshooting

- Check root cause for increased motor load.

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