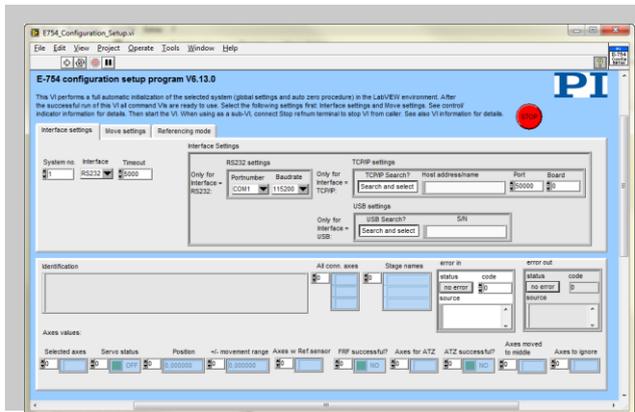


PZ263E Software Manual

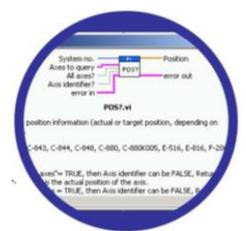
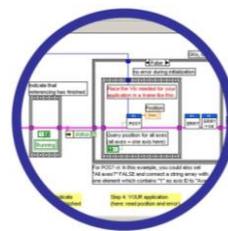
E-754 LabView Driver Library

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This document describes software for use with the following product(s):

- **E-754** Digital Piezo Controller



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Europe: EP0789937B1EP1210759B1, EP1267425B1, EP1581992B1, EP1656705B1, EP1747594B1, EP1812975B1, EP1861740B1, EP1915787B2, EP1938397B1, EP2095441B1, EP2130236B1, EP2153476B1, EP2164120B1, EP2258004B1, EP2608286A2

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China: ZL200380108542.0, ZL200580015994.3, ZL200580029560.9, ZL200580036995.6, ZL200680007223.4, ZL200680030007.1, ZL200680042853.5

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Note: This preliminary manual covers the following content:

- Introduction to the PI General Command Set (GCS)
- VI Structure
- Working with the PI GCS LabVIEW driver set
- Software updates
- First steps for the E-754 controller
- Error codes.

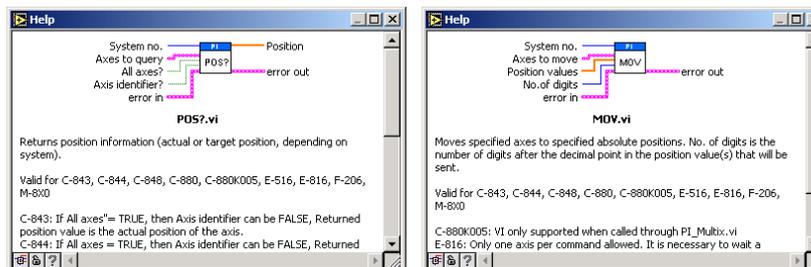
For details containing the individual VIs, please refer to the LabVIEW online help.

1. Introduction

The LabVIEW software consists of a collection of virtual instrument (VI) drivers. All functionality involves invoking one or more VIs with the appropriate parameter and global variable settings.

These VIs are provided to ease the task of programming your application. They, and the accompanying documentation, assume a prior knowledge of proper LabView programming techniques. The provided "Simple Test" and "Configuration Setup" VIs help to solve the essential initialization steps, but are not intended to provide an out-of-the-box, universal solution to a particular application.

To minimize the need for consulting the manual during programming, each VI comes with a detailed VI description that appears in the *Context Help* window when you move the cursor over the VI icon. Use the *Help*→*Show Context Help* menu sequence in the LabVIEW environment to display the *Context Help* window.



LabVIEW 8.6 or higher and NI-VISA 3.6 or higher must be installed prior to using this driver set.

To control an analog system, DAQmx 8.3 or higher and a DAQmx-compatible National Instruments DAC card which supports waveform generation must also be installed.

With Linux operating systems, the installation is done via the INSTALL script which is to be found in the /linux directory on the software CD (if available, see the controller User manual for more information).

With Windows Vista and PCI cards (C-843, C-843.PM, E-761), the VIs must always be started with the "Run as administrator" option. To do this, click on the VI with the right mouse button and select the "Run as administrator" entry from the context menu.

1.1. PI General Command Set (GCS)

This VI driver set supports the *PI General Command Set*, which is based on ASCII communication with well-defined commands and replies. This makes it possible to control different PI systems, such as the *E-517 Display Module* or the *C-880 Multi-Axis Controller*, with only one driver set simply by “wiring” the correct command parameters to the associated VIs. To achieve this, a unique “System no.” must be selected in each “XXXX_Configuration_Setup.vi” (with XXX being the PI product no. of your system). This System no. is then used in all sub-VIs to tell LabVIEW which connected system to talk to.

Translation Libraries

To control PI systems with a native command set that is not compatible with the *PI General Command Set*, e.g. the *E-710 Digital Piezo Controller* or the *C-843 Motion Control Board*, controller-specific libraries are used. Each such library translates *PI General Command Set* commands to the controller’s native language. **There is also a universal library which adds this functionality: GCSTranslator; it must be installed on the computer in the GCS_LabVIEW\Low Level folder, no matter whether the system being controlled is *PI General Command Set* compatible or not.**

For these and certain other systems (such as PC add-on cards), the required system-specific libraries and data files (e.g. PISTages2.dat) must be properly installed. If you install this driver set from within the setup program of the PI software CD ROM, this installation is done automatically. If you want to install this driver set manually, please run “GCSTranslatorSetup.exe” from the CD-ROM that came with your system. This setup tool makes sure that all necessary libraries and their data files are correctly registered in the operating system environment and can be found by the GCS drivers (if LabVIEW still cannot find PISTages2.dat, it may be because it is marked read-only. To see, open an Explorer, right-click the file PISTages2.dat and select *Properties*. Make sure that the *read-only* attribute is not checked.)

Once the libraries and data files for the system to control are installed, this LabVIEW driver set can be used to control a non-GCS-compatible system just like any GCS-compatible system, and PCI/ISA-based controller boards (see Section “First Steps for GCS-Compatible PI Controllers” on p. 9 and the online help of the “XXXX_Configuration_Setup.vi” (with XXXX being the PI product number of your system)).

Units and GCS

The GCS system uses physical units of measure. Most controllers and GCS software have default conversion factors chosen to convert hardware-dependent units (e.g. encoder counts) into mm or degrees, as appropriate. These defaults are generally taken from a database of stages that can be connected. The direction of motion associated with positive and negative relative moves can also be controlled by parameter settings. In some cases an additional scale factor can be applied, making a second physical unit available without overwriting the conversion factor for the first. It is also sometimes possible to enter a conversion factor as numerator and denominator of a fraction, reducing the number of digits and outside calculations needed for high-precision entry of gearhead system values. See the DFF.vi and SPA.vi command descriptions (if supported by your PI controller), taking special note of the sections referring specifically to your controller.

1.2. Scope of This Manual

This manual covers only VIs which can be used with the product with which it came, and VIs which must be present for all products supported by this driver set. A VI can be used with a certain product if the product name is mentioned in the “Valid for” line of the VI description..

For VIs which are based on GCS commands, see the User manual of the controller or, if present, the special GCS commands manual for further details.

1.3. VI Structure

The folder structure of the LabVIEW drivers consists of the main folder “GCS_LabVIEW” with the sub-folder “Low Level”.

The main folder “GCS_LabVIEW” contains a terminal VI (for command based systems), a configuration VI (XXXX_Configuration_Setup.vi with XXXX being the PI product number of your system), a simple test VI, and, if available, several sample programs.

The sub-folder “Low Level” contains VIs for the following functions:

- Establishing communication with different PI systems which support the PI General Command Set via RS-232, GPIB or TCP/IP interfaces, or with analog systems, defining the parameter IDs of the connected axes, sending and receiving ASCII characters to/from the specified system or setting and reading voltages for an analog system. These VIs are mainly sub-VIs for the XXXX_Configuration_Setup.vi which overtake the communication parameter setup and initialization of all necessary settings automatically.
- Support functions which are helpful for several common tasks in LabVIEW and are used by the command VIs
- Sending system-specific commands (system-specific commands are separated into function-specific LLBs) which are the “construction set” to build your application.

Additionally, the sub-folder “Low Level” contains GCSTranslator.dll.

Following the data flow concept of LabVIEW, all VIs have their wiring inputs on the left side and their wiring outputs on the right side of each connector pane. For quick integration, this **connector pane** in most cases has the following pattern:

1					15
2	7	9	11	13	16
3					17
4					18
5	8	10	12	14	19
6					20

The terminals are assigned as follows (if the mentioned, control/indicator is present in one of the supplied libraries):

- 1 System number
- 2 Optical board, Interface, or other main input control
- 3 Axes to query, Affected axes, Number of systems, or other main input control
- 4 All axes?, Invert order?, or other main input control

- 5 Axis identifier?, No. of digits, or other main input control
- 6 Error in
- 7 Parameter number, Without axis ID?, or other input control
- 8 Step size, or other input control
- 9 AA step size, or other input control
- 10 Input control
- 11 Input control or output indicator
- 12 Input control or output indicator
- 13 Input control or output indicator
- 14 Input control or output indicator
- 15 Hidden error, Connected axes, String read, or other main output indicator
- 16 Axes to query out, Bytes read, or other main output indicator
- 17 No. of rows, or other main output indicator
- 18 Output indicator
- 19 Output indicator
- 20 Error out

Also note that this driver set does not use the standard LabVIEW error numbers recommended by National Instruments, but rather those used by PI controllers. As a result, the error texts displayed by LabVIEW will not describe the error accurately. Use "GCSTranslateError.vi" to get the description of a PI GCS error number. Some VIs use an additional indicator Controller error to indicate that the selected system has been queried for a controller error with „ERR?“ and reported an error number \neq zero.

See also chapter 2 on p. 12 for a summary of error numbers produced by this driver set.

In LabVIEW, uncheck *Enable automatic error handling dialogs* in *Tools*→*Options*→*New and Changed in 7.x* to prevent that LabVIEW suspends execution and displays an error dialog box for any error that occurs during the execution of the VIs.

Important:

Before running any VIs to control a connected system, "**XXXX_Configuration_Setup.vi**" (located in the main folder, with XXXX being the PI product number of your system) must be run. This initialization VI performs all necessary steps automatically:

1. It opens the communications port,
2. It defines the IDs for the connected axes,
3. It references the connected stages (if appropriate), depending on if the controller requires a referencing before axes can be moved and on your custom settings,
4. It defines the controller name.

After these steps all parameters are saved into global variables, so that other VIs invoked during the same LabView session can access this data at runtime.

As the initialization is a complex procedure which uses a large number of sub-VIs, **XXXX_Configuration_Setup.vi** is password-protected, meaning that you cannot see or modify the diagram. In this way, the full initialization is packed into one single and fully tested procedure which you simply insert into your own application program. For security reasons as well as your convenience, we recommend that you not modify this VI.

For testing a PI system using a command-based interface, the easiest method is to call "PI Terminal.vi", which is located in the "GCS_LabVIEW" main folder. This is a "stand-alone" routine that calls "PI Ask for Communication Parameters.vi" first and then opens the specified communications ports. It does not, however, define the connected axes of the (motion) systems.

A more system-specific sample VI is "XXXX_Simple_Test.vi" (with XXXX being the PI product number of your system), also located in the "GCS_LabVIEW" main folder. It is available both for command-based and analog systems.

1.4. Working with two PI products which understand PI's General Command Set (GCS) in LabVIEW

When installing the LabVIEW programming support for two different PI products, there are two "Low Level" folders installed, one in each product-specific LabVIEW driver set. This is because every product comes with only the VIs which are used with the product. Another product may have different libraries or different library contents due to the product supporting more or fewer functions. When working with two product-specific LabVIEW driver set installations on one computer, it is important to make sure that LabVIEW always uses the right libraries.

- a) When working separately with two products, the "Low Level" folder of each product must be located in the same folder as the product-specific main VI which calls sub-VIs from the product-specific driver set. Otherwise LabVIEW will start searching for sub VIs wherever it finds them, which may result in version conflicts and "broken Run" arrows. Please make sure that no VIs are saved under LabVIEW's own "user.lib" sub-folder. If they are LabVIEW will always find them there first, which will cause errors in many cases.
- b) When working with two products in parallel, the libraries should be combined. Please use "MergePIDriver.vi", located in "C:\Users\Public\PI\PI_LabVIEW_Merge_Tool\MergeDrivers.lib" (also available via the Windows start menu), to combine two or more PI driver sets. Make sure to work thereafter with the combined libraries instead of the product-specific libraries. If you encounter any broken arrows or error messages after merging please contact your local sales representative with the following information:
 - i. Product names of PI LabVIEW drivers to merge
 - ii. Version file "version.txt" of all driver sets to merge (located in the Low Level folder of each source driver set after merging)
 - iii. Name(s) of VI(s) with broken arrows
 - iv. Error code (if any) and name of VI in which the error occurred

Before combining driver sets, please do always run PIUpdateFinder.exe to check if there is an update available for one of the driver sets to merge, or for the Merge Tool itself.

Select a unique “System no.” in each XXXX_Configuration_Setup.vi (with XXXX being the PI product number of your system) and use this System no. in all command VIs to tell LabVIEW which system to send commands to.

1.5. Software Updates

The installation disk shipped with your product may contain outdated versions of software components or drivers.

To check for the latest versions, we recommend to use the PIUpdateFinder. If this software tool has not already been installed via the CD setup, follow the instructions on <http://update.pi-portal.ws/> to download the guided installer of PIUpdateFinder.

The latest versions of software components or drivers are also available on <http://www.pi-portal.ws/> in the section of your controller or in the “General Software” section. For log-in instructions, refer to the “X-XXX Releasenews_XXX.pdf” document in the “Manuals” directory of the installation disk.

1.6. First Steps for GCS-Compatible PI Controllers

1.6.1. E-754

NOTE: Installation and settings

The setup on the E-754 CD offers the choice between a "digital" and an "analog" PI LabVIEW driver set (latter one is only available via the "Custom" installation option and will hence not be installed when choosing the "Complete" option). The digital driver set is required if you operate the E-754 over a "standard" PC interface (e.g. RS-232), while the analog driver set is needed if the E-754 is to be commanded by an analog control input signal which is generated by a DAC card in the PC. For mixed operation both driver sets must be installed. See below for how to install the driver sets manually and for the required settings.

Please see also chapter 1.5 for information about software updates.

Operation with analog control input only ("analog operation"):

To install the analog PI LabVIEW driver set manually, please start "PI_LabVIEW_Driver_Analog_Setup.exe", located in the SingleSetups subdirectory of the installation disk and follow the instructions of the guided installation process.

For analog operation, several parameter settings must be made. See the E-754 User Manual or Technical Note for details about switching to analog control. In mixed operation (see below), "SwitchToAnalogOrDigital.vi" can be used to make these settings programmatically. See "E754_Sample_Application_With_Analog.vi" as a sample VI showing how to control the E-754 via an analog or digital interface.

In analog mode, the servo status set before is valid: if servo was switched on (SVO), analog control operates in closed loop, otherwise in open loop.

Operation via standard PC interface only ("digital operation", e.g. via RS-232, TCP/IP or USB):

To install the digital PI LabVIEW driver set manually, please start "PI_LabVIEW_Driver_E-754_Setup.exe", located in the SingleSetups subdirectory of the installation disk and follow the instructions of the guided installation process.

If the controller was set to analog control before (e.g. if error 72 is returned when attempting to move an axis), use "SwitchToAnalogOrDigital.vi" to set it to digital control.

Mixed operation:

For mixed operation, please install both, the analog and digital PI LabVIEW driver set as described above, and, if not already done via the "Complete" option in the CD Setup, start the "PI_LabVIEW_Merge_Tool_Setup.exe" (also located in the SingleSetups subdirectory of the installation disk).

The PI LabVIEW Merge Tool generates one single PI LabVIEW driver set containing all previously installed PI LabVIEW drivers. For more information, please refer to the PI LabVIEW Merge Tool documentation (located in C:\Users\Public\PI\Manuals).

Switching between analog and digital operation can be achieved by using "SwitchToAnalogOr Digital.vi". See also "E754_Sample_Application_With_Analog.vi".

Step 1: The E-754 controller is delivered pre-configured. Before you start, please check that the current configuration matches your stage connections.

Step 2 (advanced users can skip this step): To check communication between the E-754 controller and the host PC, run "E754_Simple_Test.vi". This VI will return the ID string of the E-754 controller, the axis IDs and stage names of the connected axes, the current position and the help string. Use the *Help*→*Show Context Help* menu sequence in the NI LabVIEW environment to display the *Context Help* window with the VI and control/indicator descriptions.

Step 3:

WARNING: E754_Configuration_Setup.vi May Cause Move

When you start "E754_Configuration_Setup.vi" with Are stages connected? = TRUE and Perform Autozero? = TRUE or Move to Middle? = TRUE, the VI will perform an automated zero-point calibration of the connected stages and/or move all axes to their middle positions. It is therefore important to make sure that items connected to or mounted on the connected stages cannot be damaged by such a move. If a move is not desired, Are stages connected? can be switched off.

To control one or more E-754 controllers with this driver set, run "E754_Configuration_Setup.vi". This VI performs all steps necessary for a full configuration of the driver VIs in the NI LabVIEW environment: e.g. the definition of the axis IDs, the automated zero-point calibration (if appropriate) and the definition of the controller name. During your testing phase (when you simply run the VIs without wiring them together into a program), do not close "E754_Configuration_Setup.vi"; otherwise all global settings will be lost and the driver VIs will not work.

When programming your application, you can implement "E754_Configuration_Setup.vi" as an initialization VI in your software. Use the *Help*→*Show Context Help* menu sequence in the NI LabVIEW environment to display the *Context Help* window with the VI and control/indicator descriptions. See also "E754_Sample_Application_1.vi" as a sample VI showing how to implement your application using "E754_Configuration_Setup.vi".

Before using a joystick connected to the host PC, install joystick driver and calibrate joystick in the Windows control panel.

Default position unit is μm , default velocity unit is $\mu\text{m/s}$.

Default IDs:

AxisIDs are "1", "2", "3" etc.

Input Signal Channel IDs: "1", "2", "3", etc.

Note: Input Signal Channels comprise the sensor channels for the capacitive sensors in the mechanics (Number Of Sensor Channels parameter, ID 0x0E000B03) and the optional analog input channels. In the E-754 firmware, the sensor channels are always represented by the first input signal channels, while the analog input lines are always represented by the last input signal channels.

Output Signal Channel IDs: "1", "2", "3", etc.

Note: Output Signal Channels comprise the piezo voltage amplifiers dedicated to the actuators in the mechanics (Number Of Piezo Channels parameter, ID 0x0E000B04) and the optional analog output channels. In the E-754 firmware, the piezo amplifier channels are always represented by the first output signal channels, while the analog output lines are always represented by the last output signal channels.

Digital Output Line IDs: 1 to 7

GCS syntax version: 2.0

2. Appendix

Error codes are not unambiguous, but can result from a PI error message or LabVIEW internal error code. In addition to the list below see National Instruments error codes.

100	PI LabVIEW driver reports error. See source control for details.
0	No error
1	Parameter syntax error
2	Unknown command
3	Command length out of limits or command buffer overrun
4	Error while scanning
5	Unallowable move attempted on unreferenced axis, or move attempted with servo off
6	Parameter for SGA not valid
7	Position out of limits
8	Velocity out of limits
9	Attempt to set pivot point while U,V and W not all 0
10	Controller was stopped by command
11	Parameter for SST or for one of the embedded scan algorithms out of range
12	Invalid axis combination for fast scan
13	Parameter for NAV out of range
14	Invalid analog channel
15	Invalid axis identifier
16	Invalid stage name
17	Parameter out of range
18	Invalid macro name
19	Error while recording macro
20	Macro not found
21	Axis has no brake
22	Axis identifier specified more than once
23	Illegal axis or channel
24	Incorrect number of parameters
25	Invalid floating point number
26	Parameter missing
27	Soft limit out of range
28	No manual pad found
29	No more step-response values
30	No step-response values recorded

31	Axis has no reference sensor
32	Axis has no limit switch
33	No relay card installed
34	Command not allowed for selected stage(s)
35	No digital input installed
36	No digital output configured
37	No more MCM responses
38	No MCM values recorded
39	Controller number invalid
40	No joystick configured
41	Invalid axis for electronic gearing, axis can not be slave
42	Position of slave axis is out of range
43	Slave axis cannot be commanded directly when electronic gearing is enabled
44	Calibration of joystick failed
45	Referencing failed
46	OPM (Optical Power Meter) missing
47	OPM (Optical Power Meter) not initialized or cannot be initialized
48	OPM (Optical Power Meter) Communication Error
49	Move to limit switch failed
50	Attempt to reference axis with referencing disabled
51	Selected axis is controlled by joystick
52	Controller detected communication error
53	Command is not allowed while the affected axis is in motion.
54	Unknown parameter
55	No commands were recorded with REP
56	Password invalid
57	Data Record Table does not exist
58	Source does not exist; number too low or too high
59	Source Record Table number too low or too high
60	Protected Param: current Command Level (CCL) too low
61	Command execution not possible while Autozero is running
62	Autozero requires at least one linear axis
63	Initialization still in progress
64	Parameter is read-only
65	Parameter not found in non-volatile memory
66	Voltage out of limits
67	Not enough memory available for requested wave curve
68	Not enough memory available for DDL table; DDL can not be started
69	Time delay larger than DDL table; DDL can not be started
70	The requested arrays have different lengths; query them separately

71	Attempt to restart the generator while it is running in single step mode
72	Motion commands and wave generator activation are not allowed when analog target is active
73	Motion commands are not allowed when wave generator output is active; use WGO to disable generator output
74	No sensor channel or no piezo channel connected to selected axis (sensor and piezo matrix)
75	Generator started (WGO) without having selected a wave table (WSL).
76	Interface buffer did overrun and command couldn't be received correctly
77	Data Record Table does not hold enough recorded data
78	Data Record Table is not configured for recording
79	Open-loop commands (SVA, SVR) are not allowed when servo is on
80	Hardware error affecting RAM
81	Not macro command
82	Macro counter out of range
83	Joystick is active
84	Motor is off
85	Macro-only command
86	Invalid joystick axis
87	Joystick unknown
88	Move without referenced stage
89	Command not allowed in current motion mode
90	No tracing possible while digital IOs are used on this HW revision. Reconnect to switch operation mode.
91	Move not possible, would cause collision
92	Stage is not capable of following the master. Check the gear ratio(SRA).
93	This command is not allowed while the affected axis or its master is in motion.
94	Servo cannot be switched on when open-loop joystick control is enabled.
95	This parameter cannot be changed in current servo mode.
96	Unknown stage name
97	Invalid length of value (too much characters)
98	AutoZero procedure was not successful
99	Sensor voltage is OFF
100	PI LabVIEW driver reports error. See source control for details.
200	No stage connected to axis
201	File with axis parameters not found
202	Invalid axis parameter file
203	Backup file with axis parameters not found
204	PI internal error code 204
205	SMO with servo on
206	uudecode: incomplete header

207	uudecode: nothing to decode
208	uudecode: illegal UUE format
209	CRC32 error
210	Illegal file name (must be 8-0 format)
211	File not found on controller
212	Error writing file on controller
213	VEL command not allowed in DTR Command Mode
214	Position calculations failed
215	The connection between controller and stage may be broken
216	The connected stage has driven into a limit switch, some controllers need CLR to resume operation
217	Strut test command failed because of an unexpected strut stop
218	While MOV! is running position can only be estimated!
219	Position was calculated during MOV motion
230	Invalid handle
231	No bios found
232	Save system configuration failed
233	Load system configuration failed
301	Send buffer overflow
302	Voltage out of limits
303	Open-loop motion attempted when servo ON
304	Received command is too long
305	Error while reading/writing EEPROM
306	Error on I2C bus
307	Timeout while receiving command
308	A lengthy operation has not finished in the expected time
309	Insufficient space to store macro
310	Configuration data has old version number
311	Invalid configuration data
333	Internal hardware error
400	Wave generator index error
401	Wave table not defined
402	Wave type not supported
403	Wave length exceeds limit
404	Wave parameter number error
405	Wave parameter out of range
406	WGO command bit not supported
500	The "red knob" is still set and disables system
501	The "red knob" was activated and still disables system - reanimation required
502	Position consistency check failed

503	Hardware collision sensor(s) are activated
504	Strut following error occurred, e.g. caused by overload or encoder failure
505	One sensor signal is not valid
506	Servo loop was unstable due to wrong parameter setting and switched off to avoid damage.
507	digital connection to external spi slave device is lost
530	A command refers to a coordinate system that does not exist
531	A command refers to a coordinate system that has no parent node
532	Attempt to delete or change a coordinate system that is in use
533	Definition of a coordinate system is cyclic
536	Coordinate system cannot be defined as long as Hexapod is in motion
537	Coordinate system type is not intended for manual enabling
539	A coordinate system cannot be linked to itself
540	Coordinate system definition is erroneous or not complete (replace or delete it)
542	The coordinate systems are not part of the same chain
543	Unused coordinate system must be deleted before new coordinate system can be stored
544	With this coordinate system type SPI usage is not supported
545	Soft limits invalid due to changes in coordinate system
546	Coordinate system is write protected
547	Coordinate system cannot be changed because its content is loaded from a configuration file
548	Coordinate system may not be linked
549	A KSB-type coordinate system can only be rotated by multiples of 90 degrees
551	This query is not supported for this coordinate system type
552	This combination of work and tool coordinate systems does not exist
553	The combination must consist of one work and one tool coordinate system
554	This coordinate system type does not exist
555	BasMac: unknown controller error
556	No coordinate system of this type is enabled
557	Name of coordinate system is invalid
558	File with stored CS systems is missing or erroneous
559	File with leveling CS is missing or erroneous
601	Not enough memory
602	Hardware voltage error
603	Hardware temperature out of range
604	Position error of any axis in the system is too high
606	Maximum value of input signal has been exceeded
607	Value is not integer
608	Fast alignment process cannot be paused because it is not running

609	Fast alignment process cannot be restarted/resumed because it is not paused
650	Parameter could not be set with SPA - SEP needed?
651	Phase finding error
652	Sensor setup error
653	Sensor communication error
654	Motor amplifier error
655	Overcurrent protection triggered by I2T-module
656	Overcurrent protection triggered by amplifier module
657	Safety stop triggered
658	Sensor off?
700	Command not allowed in external mode
710	External mode communication error
715	Invalid mode of operation
716	Firmware stopped by command (#27)
717	External mode driver missing
718	Missing or incorrect configuration of external mode
719	External mode cycletime invalid
731	Command not allowed while surface drive is running
732	Last surface drive failed
1000	Too many nested macros
1001	Macro already defined
1002	Macro recording not activated
1003	Invalid parameter for MAC
1004	Deleting macro failed
1005	Controller is busy with some lengthy operation (e.g. reference move, fast scan algorithm)
1006	Invalid identifier (invalid special characters, ...)
1007	Variable or argument not defined
1008	Controller is (already) running a macro
1009	Invalid or missing operator for condition. Check necessary spaces around operator.
1010	No answer was received while executing WAC/MEX/JRC/...
1011	Command not valid during macro execution
1024	Motion error: position error too large, servo is switched off automatically
1063	User Profile Mode: Command is not allowed, check for required preparatory commands
1064	User Profile Mode: First target position in User Profile is too far from current position
1065	Controller is (already) in User Profile Mode
1066	User Profile Mode: Block or Data Set index out of allowed range
1071	User Profile Mode: Out of memory

1072	User Profile Mode: Cluster is not assigned to this axis
1073	Unknown cluster identifier
1090	There are too many open tcpip connections
2000	Controller already has a serial number
4000	Sector erase failed
4001	Flash program failed
4002	Flash read failed
4003	HW match code missing/invalid
4004	FW match code missing/invalid
4005	HW version missing/invalid
4006	FW version missing/invalid
4007	FW update failed
4008	FW Parameter CRC wrong
4009	FW CRC wrong
5000	PicoCompensation scan data is not valid
5001	PicoCompensation is running, some actions can not be executed during scanning/recording
5002	Given axis can not be defined as PPC axis
5003	Defined scan area is larger than the travel range
5004	Given PicoCompensation type is not defined
5005	PicoCompensation parameter error
5006	PicoCompensation table is larger than maximum table length
5100	Common error in Nexline firmware module
5101	Output channel for Nexline can not be redefined for other usage
5102	Memory for Nexline signals is too small
5103	RNP can not be executed if axis is in closed loop
5104	relax procedure (RNP) needed
5200	Axis must be configured for this action
6000	Invalid preset value of absolute sensor
6001	Error while writing to sensor
6002	Error while reading from sensor
6003	Checksum error of absolute sensor
6004	General error of absolute sensor
6005	Overflow of absolute sensor position
0	No error occurred during function call
-1	Error during com operation (could not be specified)
-2	Error while sending data
-3	Error while receiving data
-4	Not connected (no port with given ID open)
-5	Buffer overflow

-6	Error while opening port
-7	Timeout error
-8	There are more lines waiting in buffer
-9	There is no interface or DLL handle with the given ID
-10	Event/message for notification could not be opened
-11	Function not supported by this interface type
-12	Error while sending "echoed" data
-13	IEEE488: System error
-14	IEEE488: Function requires GPIB board to be CIC
-15	IEEE488: Write function detected no listeners
-16	IEEE488: Interface board not addressed correctly
-17	IEEE488: Invalid argument to function call
-18	IEEE488: Function requires GPIB board to be SAC
-19	IEEE488: I/O operation aborted
-20	IEEE488: Interface board not found
-21	IEEE488: Error performing DMA
-22	IEEE488: I/O operation started before previous operation completed
-23	IEEE488: No capability for intended operation
-24	IEEE488: File system operation error
-25	IEEE488: Command error during device call
-26	IEEE488: Serial poll-status byte lost
-27	IEEE488: SRQ remains asserted
-28	IEEE488: Return buffer full
-29	IEEE488: Address or board locked
-30	RS-232: 5 data bits with 2 stop bits is an invalid combination, as is 6, 7, or 8 data bits with 1.5 stop bits
-31	RS-232: Error configuring the COM port
-32	Error dealing with internal system resources (events, threads, ...)
-33	A DLL or one of the required functions could not be loaded
-34	FTDIUSB: invalid handle
-35	FTDIUSB: device not found
-36	FTDIUSB: device not opened
-37	FTDIUSB: IO error
-38	FTDIUSB: insufficient resources
-39	FTDIUSB: invalid parameter
-40	FTDIUSB: invalid baud rate
-41	FTDIUSB: device not opened for erase
-42	FTDIUSB: device not opened for write
-43	FTDIUSB: failed to write device
-44	FTDIUSB: EEPROM read failed

-45	FTDIUSB: EEPROM write failed
-46	FTDIUSB: EEPROM erase failed
-47	FTDIUSB: EEPROM not present
-48	FTDIUSB: EEPROM not programmed
-49	FTDIUSB: invalid arguments
-50	FTDIUSB: not supported
-51	FTDIUSB: other error
-52	Error while opening the COM port: was already open
-53	Checksum error in received data from COM port
-54	Socket not ready, you should call the function again
-55	Port is used by another socket
-56	Socket not connected (or not valid)
-57	Connection terminated (by peer)
-58	Can't connect to peer
-59	Operation was interrupted by a nonblocked signal
-60	No Device with this ID is present
-61	Driver could not be opened (on Vista: run as administrator!)
-62	Host not found
-63	Device already connected
-1001	Unknown axis identifier
-1002	Number for NAV out of range--must be in [1,10000]
-1003	Invalid value for SGA--must be one of 1, 10, 100, 1000
-1004	Controller sent unexpected response
-1005	No manual control pad installed, calls to SMA and related commands are not allowed
-1006	Invalid number for manual control pad knob
-1007	Axis not currently controlled by a manual control pad
-1008	Controller is busy with some lengthy operation (e.g. reference move, fast scan algorithm)
-1009	Internal error--could not start thread
-1010	Controller is (already) in macro mode--command not valid in macro mode
-1011	Controller not in macro mode--command not valid unless macro mode active
-1012	Could not open file to write or read macro
-1013	No macro with given name on controller, or macro is empty
-1014	Internal error in macro editor
-1015	One or more arguments given to function is invalid (empty string, index out of range, ...)
-1016	Axis identifier is already in use by a connected stage
-1017	Invalid axis identifier
-1018	Could not access array data in COM server

- 1019 Range of array does not fit the number of parameters
- 1020 Invalid parameter ID given to SPA or SPA?
- 1021 Number for AVG out of range--must be >0
- 1022 Incorrect number of samples given to WAV
- 1023 Generation of wave failed
- 1024 Motion error: position error too large, servo is switched off automatically
- 1025 Controller is (already) running a macro
- 1026 Configuration of PZT stage or amplifier failed
- 1027 Current settings are not valid for desired configuration
- 1028 Unknown channel identifier
- 1029 Error while reading/writing wave generator parameter file
- 1030 Could not find description of wave form. Maybe WG.INI is missing?
- 1031 The WGWaveEditor DLL function was not found at startup
- 1032 The user cancelled a dialog
- 1033 Error from C-844 Controller
- 1034 DLL necessary to call function not loaded, or function not found in DLL
- 1035 The open parameter file is protected and cannot be edited
- 1036 There is no parameter file open
- 1037 Selected stage does not exist
- 1038 There is already a parameter file open. Close it before opening a new file
- 1039 Could not open parameter file
- 1040 The version of the connected controller is invalid
- 1041 Parameter could not be set with SPA--parameter not defined for this controller!
- 1042 The maximum number of wave definitions has been exceeded
- 1043 The maximum number of wave generators has been exceeded
- 1044 No wave defined for specified axis
- 1045 Wave output to axis already stopped/started
- 1046 Not all axes could be referenced
- 1047 Could not find parameter set required by frequency relation
- 1048 Command ID given to SPP or SPP? is not valid
- 1049 A stage name given to CST is not unique
- 1050 A uuencoded file transfered did not start with "begin" followed by the proper filename
- 1051 Could not create/read file on host PC
- 1052 Checksum error when transferring a file to/from the controller
- 1053 The PiStages.dat database could not be found. This file is required to connect a stage with the CST command
- 1054 No wave being output to specified axis
- 1055 Invalid password
- 1056 Error during communication with OPM (Optical Power Meter), maybe no OPM

- connected
- 1057 WaveEditor: Error during wave creation, incorrect number of parameters
 - 1058 WaveEditor: Frequency out of range
 - 1059 WaveEditor: Error during wave creation, incorrect index for integer parameter
 - 1060 WaveEditor: Error during wave creation, incorrect index for floating point parameter
 - 1061 WaveEditor: Error during wave creation, could not calculate value
 - 1062 WaveEditor: Graph display component not installed
 - 1063 User Profile Mode: Command is not allowed, check for required preparatory commands
 - 1064 User Profile Mode: First target position in User Profile is too far from current position
 - 1065 Controller is (already) in User Profile Mode
 - 1066 User Profile Mode: Block or Data Set index out of allowed range
 - 1067 ProfileGenerator: No profile has been created yet
 - 1068 ProfileGenerator: Generated profile exceeds limits of one or both axes
 - 1069 ProfileGenerator: Unknown parameter ID in Set/Get Parameter command
 - 1070 ProfileGenerator: Parameter out of allowed range
 - 1071 User Profile Mode: Out of memory
 - 1072 User Profile Mode: Cluster is not assigned to this axis
 - 1073 Unknown cluster identifier
 - 1074 The installed device driver doesn't match the required version. Please see the documentation to determine the required device driver version.
 - 1075 The library used doesn't match the required version. Please see the documentation to determine the required library version.
 - 1076 The interface is currently locked by another function. Please try again later.
 - 1077 Version of parameter DAT file does not match the required version. Current files are available at www.pi.ws.
 - 1078 Cannot write to parameter DAT file to store user defined stage type.
 - 1079 Cannot create parameter DAT file to store user defined stage type.
 - 1080 Parameter DAT file does not have correct revision.
 - 1081 User stages DAT file does not have correct revision.
 - 1082 Timeout Error. Some lengthy operation did not finish within expected time.
 - 1083 A function argument has an unexpected datatype.
 - 1084 Length of data arrays is different.
 - 1085 Parameter value not found in parameter DAT file.
 - 1086 Macro recording is not allowed in this mode of operation.



End of document