RN
Release note

Motor Control Library for 32-bit Power Architecture® MCU's

Release Note

Giuseppe Russo

Approved	Checked	Date	Rev
Luca Valsecchi	28/Jun/2017	29/Jun/2017	4.0

Reference: Release Note

About this Release Note

This Release Note contains all the relevant information about the latest version of the Motor Control Library developed for 32-bit Power Architecture® MCU's available on ST intranet web site and the needed steps to follow for installing or upgrading the motor control package component into SPC5Studio development tool

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Distribution List

For your Information
ADG Senior Managers
Receiver
All relevant stakeholders

Giuseppe Russo

Approved	Checked	Date	Rev
Luca Valsecchi	28/Jun/2017	29/Jun/2017	4.0

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Document History

Date	Version	Author	Comment
16/Dec/2016	0.9	Giuseppe Russo	First Release
19/Dec/2016	1.0	Giuseppe Russo	Approved
30/03/2017	1.1	Giuseppe Russo	Added EAR_0.8.2 info
31/03/2017	2.0	Giuseppe Russo	Approved
31/05/2017	2.1	Giuseppe Russo	Added BETA_0.9.0 info
06/05/2017	3.0	Giuseppe Russo	Approved
27/07/2017	3.1	Giuseppe Russo	Added BETA_0.9.1 info
29/07/2017	4.0	Giuseppe Russo	Approved

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1. Delivery information

1.1 Delivery name

MCTK_BETA_0.9.1

1.2 Changes in version MCTK_BETA_0.9.1

This release, classified as BETA, contains new features and bug fix of the product with a basic load test.

What's new:

- **Motor Component (configuration plug-in and library):**
  - Added support for SPC56EL70L5 MCU and SPC56L-Discovery kit
  - Added CAN communication support in compliancy with the motor control command protocol available only on UART in former releases
  - Added the capability of performing multiple ADC User conversions inside the FOC control loop in CTU mode
  - Aligned diagnostic and bus sensing feature for different micro
  - Alignment to 5.5 SPC5Studio version
- **User Manual,** updated with new features

Fixed Issues

Respect to the v0.9.0, internally dropped to the project codex space:

- Removed some issue related to DMA
- Fixed an issue on ADC User conversion in injection mode for Pictus 256K
- Renamed motor control component to match both Leopard and Pictus
- SPC5Studio plug-in configuration improvement

1.3 Recommendations

- In order to install the motor control library and set up the whole HW+SW toolkit, we recommend to follow the Quick Start Guide provided with this release. **Make sure you have SPC5Studio v.5.5 installed.** If not, Get SPC5Studio from www.st.com/spc5studio and install it by reading carefully installation procedure and additional document and tutorials. For those users using SPC5-UDESTK starterkit, starting from the SPC5Studio v5.0.1 it is recommended to use the PLS-UDE v4.8.x retrievable from PLS-UDE website at this link (http://www.pls-mc.com/spc5-udestk). To enable the binding between SPC5Studio and PLS-UDE v4.8.2 read carefully the How to bind SPC5studio v5.x and PLS-USE 4.8.2 documentation present into the release package.

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- Launch the **SPC5 Motor Control Live Monitor Setup file** provided in the installation package
- Remove existing motor control demo application (close and open SPC5Studio tool) and import the latest one provided with the BETA_0.9.1 package. If after the import of the demo application SPC5Studio asks to save the configuration file the import doesn't succeed. Repeat the current step.
- In case you are using an old version of SPC5 motor control live monitor, please uninstall from the windows control panel before proceeding with the new installation.

1.4 Release path

Current release is available from the ST codex space at the following address:

https://codex.cro.st.com/file/showfiles.php?group_id=4300

in case you have problem to access, please don't hesitate to contact project space administrator from codex web page.

1.5 Nature of Release

Destination/Type		Description
Internal	x	Only SW Team and beta user have access
External		Shareable externally.
Patch		Includes hot fix or customization for specific customer, delivered through specific update site link
Major		Includes a big list of items, new key features that radically changes the shape and the usage of the tool
Minor	x	Includes New functionalities and bug fix

1.6 Delivered documents listing

File Name	Delivered Version
Release Note	4.0
Quick Start Guide	1.6
Reference Manual chm	3.0
Data Brief Library	1.1
Data Brief SPC5-MCTK-01	1.4
Video pill tutorial	1.1

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1.7 Customer Support

For any issue on this release please refer to ADG-ADD Application, Software and Tools System Software development team

1.8 Issues

1.8.1 Known Issues

- Instability using s-less at speed lower than 500 rpm

1.8.2 Fixed Issues

aid	cr_type	description
441966	Defect	Should be added control checking in the ADC list in control stage section because the ADC regular conversion name must be unique in the list.
442691	NewWork	Update the Bus Voltage feature for Leopard platform.
442702	NewWork	The ADC User Regular and Multiple Conversions must be updated for the Leopard platform.
442706	NewWork	The ADC User Regular conversions must work also for Leopard platform.
443928	Defect	In the ADC multiple user conversion feature, the couple of ADC module and channel must be unique.
444008	Defect	For Current Sensing the ADC module and Channel must be unique.
433399	NewWork	Modify the UI communication in order to send/receive can frame from live monitor in compliancy with the motor control protocol
440895	Defect	The DMA clear flag is not configurable in the interrupt service routine (ISR).
441672	NewWork	The user must have the ability to request multiple "ADC conversions".
441678	NewWork	Update DEMO to test multiple ADC conversion
441877	NewWork	The demo for CAN communication should select the CAN in drive management and set BAudrate to 500 kbps
442003	NewWork	Add support for ADC multiple User conversion (part 2).
442428	NewWork	To add Leopard 2M to Motor Control Component, we have to add a new directory with Leopard Header file.From HW point of view PWM_H1 should be configured differently from MC connector of L9907, because A22 and B23 do not fit the need.
442468	NewWork	Remove required Feature from Plugin component to have it available in Leopard:
442716	NewWork	Verify whenever is used SPC560PXX and find a solution to replace SPC56XX

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442717	NewWork	Component name must be renamed from SPC560Pxx L9907 Component RLA to SPC56xx L9907 Component RLA
442719	NewWork	to rename a component ID and name need to be change either in: 1. Overview 2. Extensions Moreover update the feature to have change visible
442847	Defect	ADC User conversion in injection mode doesn't work for Pictus 256K. The ICS_GetMultipleRegularConv function must be fixed to support also Pictus 256K (only 1 ADC module).
443182	Defect	The ADC buffer doesn't update correctly. The condition to reset the index value is incorrect.
443326	Defect	ADC User conversion must be executed also when the motor is in stop mode (after start-up).When the motor switch in stop mode, the CTU is stopped and the ADC conversions are not executed.
446252	NewWork	Update demo application to SPC5studio v 5.5
443890	Defect	FLEXPWM Module 1 must be selectable in Control stage section when Leopard platform is used. In Reg_eSys_FlexPWM.h (for Leopard and Pictus) the PWM_FLEXPWM_0 and PWM_FLEXPWM_1 can be removed.

1.9 Potential Effects of bug fixes on Functionalities

No evidence.

1.10 Changes in version MCTK_BETA_0.9.0

This release, classified as BETA, contains new features and bug fix of the product with a basic load test.

What's new:

- **Motor Component (configuration plug-in and library):**
  - Added support for STGAP1S IGBT/FET galvanic isolated driver for high voltage traction inverter application
  - Diagnostic and bus sensing feature
  - Compiler optimization with selectable module enablement/disablement
  - Alignment to 5.3.2 SPC5Studio version
- **Smart driver component:**
  - STGAP1S class and dedicated component
  - Fixed issue on L99ASC03_CMD3_CONFIGURATION and L99ASC03_CMD4_CONFIGURATION calculated in the spc5_L99ASC03_cfg.h file.
- **User Manual,** updated with new features

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Fixed Issues

Respect to the v0.8.2, internally dropped to the project codex space:

- Removed compilation warning and errors present in different multiple sensors configuration
- SPC5Studio plug-in configuration improvement
- Improved compilation time

1.11 Recommendations

- In order to install the motor control library and set up the whole HW+SW toolkit, we recommend to follow the Quick Start Guide provided with this release. **Make sure you have SPC5Studio v.5.3.2 installed.** If not, Get SPC5Studio from www.st.com/spc5studio and install it by reading carefully installation procedure and additional document and tutorials. For those users using SPC5-UDESTK starterkit, starting from the SPC5Studio v5.0.1 it is recommended to use the PLS-UDE v4.8.x retrievable from PLS-UDE website at this link (http://www.pls-mc.com/spc5-udestk). To enable the binding between SPC5Studio and PLS-UDE v4.8.2 read carefully the How to bind SPC5studio v5.x and PLS-USE 4.8.2 documentation present into the release package.
- Launch the **SPC5 Motor Control Live Monitor Setup file** provided in the installation package
- Remove existing motor control demo application (close and open SPC5Studio tool) and import the latest one provided with the BETA_0.9.0 package. If after the import of the demo application SPC5Studio asks to save the configuration file the import doesn't succeed. Repeat the current step.
- In case you are using an old version of SPC5 motor control live monitor, please uninstall from the windows control panel before proceeding with the new installation.

1.12 Release path

Current release is available from the ST codex space at the following address:

https://codex.cro.st.com/file/showfiles.php?group_id=4300

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1.13 Nature of Release

Destination/Type		Description

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Internal	x	Only SW Team and beta user have access
External		Shareable externally.
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Major		Includes a big list of items, new key features that radically changes the shape and the usage of the tool
Minor	x	Includes New functionalities and bug fix

1.14 Delivered documents listing

File Name	Delivered Version
Release Note	3.0
Quick Start Guide	1.4
Reference Manual chm	1.0
Data Brief	1.4
Video pill tutorial	1.1

1.15 Customer Support

For any issue on this release please refer to ADG-ADD Application, Software and Tools System Software development team

1.16 Issues

1.16.1 Known Issues

- Instability using s-less at speed lower than 500 rpm

1.16.2 Fixed Issues

aid	cr_type	description
404856	NewWork	Provide a first implementation of diagnostic management.
409220	Defect	Verify the PWM IDLE management mode when the motor is put in stop mode or in fault state.
420013	Defect	virtual Bus sensing is always enabled
421971	Defect	SERIAL_COMMUNICATION must be set ENABLE/DISABLE from configuration
421974	Defect	HALL_AVERAGING_FIFO_DEPTH is not correctly managed in HALL_SpeednPosFdbkClass.c
429754	NewWork	The DEMO shall be updated accordingly to the sprint_3 modifications.

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433853	NewWork	A fault detection API must be added.
434046	Defect	The "Complemented from high side field" in power stage is not clear.
434771	Defect	The Hall sensor placement electrical angle must be updated to allow 1 degrees of resolution
435141	Defect	In Torque control Mode some parameter need to be calculated in configuration:
435635	NewWork	Should be added a new management to debug RPM computation.
436458	Defect	Currently if the auxiliary sensor is not enabled, the HALL and ENCODER Interfaces are however enabled, even if they are not needed.
436583	Defect	In case FF is enabled Magnetic Structure = SM-PMSM CONSTANT1_Q and CONSTANT1_D shall be evaluated with Lq = Ld = Ls (The only one Inductance value enabled in the motor parameters window)
436764	NewWork	The GAP class, developed for High Voltage, must be integrated in the Motor Control library.
437294	Defect	The L99ASC03_CMD3_CONFIGURATION and L99ASC03_CMD4_CONFIGURATION are wrong calculated in the spc5_L99ASC03_cfg.h file.
437316	NewWork	In file MCLibraryConf.h must be added the following defines. They are the pool dimensions needed for the GAP and GDC classes.
437387	NewWork	A new DEMO, to manage the STGAP1S smart power device, must be created to test/verify the new STGAP1S smart power devices.
437434	NewWork	The hSpeedThreshold parameter defined in the hall sensor interface is the threshold used to select speed measurement among two consecutive edges of the different or the same hall sensor signals. This threshold should take in account also the number of motor polar pairs.
437451	Defect	Some files contain wrong "components.h" file inclusion.
437804	NewWork	To debug sensorless applications should be implement a circular buffer for BEMF and one for Speed, the speed buffer should have also a counter to provide a method to sample only few sample
437949	NewWork	L9907 should use hex number instead of binary because some compiler will complain
438807	NewWork	New API called L9907_CheckErrors(), L9907_Schedule() and L9907_FaultAck() should be created like the ones of the GAP component.
438926	NewWork	Update Demo to support conditional compilation of serial communication
439016	NewWork	The Motor Control library must be updated to latest version of SPC5Studio (5.3.0)
439075	NewWork	Update DEMO for MCTK library to Spc5Studio 5.3.0
439099	Defect	Update ICS class Description to include even sensing on shunt resistors.
439201	NewWork	L99ASC03 should use hex number instead of binary because some compiler will complain.

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439235	NewWork	The ADC Conversion Timing Registers (CTR0) can be updated when ADC clock is set to 60MHz.
439345	NewWork	Update SMART POWER for MCTK library to Spc5Studio 5.3.0
439782	Defect	main.dox need to be updated for new features

1.17 Potential Effects of bug fixes on Functionalities

No evidence.

1.18 Changes in version MCTK_EAR_0.8.2

This release, classified as EARLY, contains new features and bug fix of the product with a basic level of testing.

What's new:

- **Motor Component (configuration plug-in and library):**
  - Added support for SPC56P34L1 microcontroller using one single ADC module
  - FlexPWM module usage configuration (Module 0, 1 and 2 or Module 0,1, 2 and 3)
  - Current sense on shunt resistor in addition to the motor phases sense with adjustable PWM max modulation
  - Motor control algorithms implemented for specific needs: Max Torque Per Ampere, Flux Weakening and Feed Forward (source code released by request)
  - ADC user channel configuration allowing user to trigger measurement from external channel.
- **Smart driver component:** L9907 and L99ASC03 FET driver support
- **Quick Start Guide,** Updated with quick motor setting infographic
- **User Manual,** updated with new features
-

Fixed Issues

Respect to the v0.8.1, internally dropped to the project codex space:

- Removed limitation on max current
- Removed compilation warning and errors present in different multiple sensors configuration
- SPC5Studio plug-in configuration improvement
- Wrong Kp value for Torque and Flux in case of I-PMSM

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1.19 Recommendations

- In order to install the motor control library and set up the whole HW+SW toolkit, we recommend to follow the Quick Start Guide provided with this release. **Make sure you have SPC5Studio v.5.2.3 installed.** If not, Get SPC5Studio from www.st.com/spc5studio and install it by reading carefully installation procedure and additional document and tutorials.
- Launch the **SPC5 Motor Control Live Monitor Setup file** provided in the installation package
- Remove existing motor control demo application (close and open SPC5Studio tool) and import the latest one provided with the EAR_0.8.2 package. If after the import of the demo application SPC5Studio asks to save the configuration file the import doesn't succeed. Repeat the current step.
- In case you are using an old version of SPC5 motor control live monitor, please uninstall from the windows control panel before proceeding with the new installation.

1.20 Release path

Current release is available from the ST codex space at the following address:

https://codex.cro.st.com/file/showfiles.php?group_id=4300

in case you have problem to access, please don't hesitate to contact project space administrator from codex web page.

1.21 Nature of Release

Destination/Type		Description
Internal	x	Only SW Team and beta user have access
External		Shareable externally.
Patch		Includes hot fix or customization for specific customer, delivered through specific update site link
Major		Includes a big list of items, new key features that radically changes the shape and the usage of the tool
Minor	x	Includes New functionalities and bug fix

1.22 Delivered documents listing

File Name	Delivered Version
Release Note	2.0
Quick Start Guide	1.4

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Reference Manual chm	1.0
Data Brief	1.3
Video pill tutorial	1.1

1.23 Customer Support

For any issue on this release please refer to ADG-ADD Application, Software and Tools System Software development team

1.24 Issues

1.24.1 Known Issues

- Some registers value from live monitor, in the Register Tab may be not correctly reported.
- Instability using s-less at speed lower than 500 rpm

1.24.2 Fixed Issues

409380	Defect	FOC execution rate do not work in sensorless
411540	NewWork	DEMO Pictus 256K for Omron board
409180	Defect	Speed regulator need new default value for K and KI FOC Update can be removed as already in tab Torque and flux regulators -> Execution Rate. To clarify Driver settings TAB, Add groups as per workbench
409216	Defect	The Encoder class doesn't compute the RPM values when index signal is not available. The control stage section must be updated.
409218	NewWork	The PWM outputs must be disabled during DEBUG mode. Should be verified if the FLEX PWM supports this features.
410343	NewWork	Current sensing with single ADC module
412537	NewWork	Add Low resources for FlexPWM (FlexPWM_SubModule_3 available)
412999	NewWork	Create early version of L99ASC03 component:
414728	Defect	The following pre-processor definitions must be moved from the MCTasks.c file into the configuration header files in order to allow to configure them and change their values accordingly to the final product. #define CHARGE_BOOT_CAP_ENABLING #define CHARGE_BOOT_CAP_ENABLING2 #define CHARGE_BOOT_CAP_MS #define CHARGE_BOOT_CAP_MS2 #define OFFCALIBRWAIT_MS #define OFFCALIBRWAIT_MS2

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		#define STOPPERMANENCY_MS #define STOPPERMANENCY_MS2
415366	NewWork	The following features should be updated: 1) Added in plugin.xml file selection of current sensing on LEGS or PHASE 2) Updated ICS_GetPhaseCurrents API in order to read the current on legs inverter 3) Added in plugin.xml file the PWM max modulation
415433	Defect	compiler error when Resolver is disabled
415874	Defect	SPC5Studio motor component description reports the following: " Eclipse plugin C code generator tool ....for all the ST ...(ST PMSM FOC FW library 3.0 or later)...."
416798	NewWork	Starting from the UM of the STM32, the Motor control Protocol shall be created to show the serial communication protocol.
419623	Defect	When I-PMSM type of motor is selected into the motor tab of the motor control component, the Kp and Ki for torque and Flux generated into the "Drive parameter.h" file, must be calculated correctly:
420846	NewWork	Add protected Header file in the MC library in CPROT directory
413668	NewWork	Configuration of ICS legs current measurement
415528	NewWork	Update the main file for the L99ASC03 usage
419079	NewWork	Wrong IQMAX calculation
419429	NewWork	Implement formula for MTPA + FF + Flux Weakening
420844	NewWork	Added ADC regular conversion management
421068	NewWork	Update DEMO for MC library 0.8.2
421075	NewWork	Update the Doxyfile for EAR 0.8.2 release

1.25 Potential Effects of bug fixes on Functionalities

No evidence.

1.26 Changes in version MCTK_EAR_0.8.1

This release, classified as EARLY, contains most of the planned features for the product with a basic level of testing.

What's new:

- **Motor Component** installable and fully integrated into SPC5Studio V5.x software development environment through the update site provided in the package release. Follow the Quick Start Guide documentation to install the package and configure the HW kit.
    - SPC5 PMSM/BLDC FOC library managing single vector motor control

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  - Configurable Speed/position sensors (Encoder, Hall, Resolver) as well as sensorless operation are supported thought motor control configuration component
  - Current reading topologies based on 2 ICS (isolated current sensor)
  - Speed and Torque control
  - Compliancy with FreeGCC, Hightec and Green Hills compiler
  - Full customization and real time communication through SPC5 Live Monitor.
  - Firmware ANSI C.
  - SPC56 microcontrollers supported: P-Line
- **Smart driver component** to configure the used smart power component
- **SPC5Studio motor control demo application** allowing to run speed/torque control with sensors and sensorless configuration, allowable to be configured for custom brushless motors and L9907 behaviour.
- **Quick Start Guide,** to set up the motor control toolkit based on SPC560P-DISP, EVAL-L9907.
- **SPC5 Motor Control Live Monitor installation package**, to install on PC the external live monitor tool to control via COM running motor and configure on fly FOC algorithm running on the target
- **User Manual,** explaining main component and usage of the motor control library

Fixed Issues

Respect to the v0.8.0, internally dropped to the project codex space:

- Porting to RLA
- GHS compiler support

1.27 Recommendations

- In order to install the motor control library and set up the whole HW+SW toolkit, we recommend to follow the Quick Start Guide provided with this release.
- Launch the **SPC5 Motor Control Live Monitor Setup file** provided in the installation package
- In case you are using an old version of SPC5Studio motor control component, please uninstall from SPC5Studio before proceeding with the new installation.
- In case you are using an old version of SPC5 motor control live monitor, please uninstall from the windows control panel before proceeding with the new installation.

1.28 Release path

Current release is available from the ST codex space at the following address:

https://codex.cro.st.com/file/showfiles.php?group_id=4300

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1.29 Nature of Release

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External		Shareable externally.
Patch		Includes hot fix or customization for specific customer, delivered through specific update site link
Major	X	Includes a big list of items, new key features that radically changes the shape and the usage of the tool
Minor		Includes New functionalities and bug fix

1.30 Delivered documents listing

File Name	Delivered Version
Release Note	2.0
Quick Start Guide	1.5
Reference Manual chm	1.1
Data Brief	1.2
Video pill tutorial	1.0
Motor Control Protocol for serial communication	1.0

1.31 Customer Support

For any issue on this release please refer to ADG-ADD Application, Software and Tools System Software development team

1.32 Issues

1.32.1 Known Issues

Some registers value from live monitor, in the Register Tab may be not correctly reported.

1.32.2 Fixed Issues

Id	cr_type	description
403269	NewWork	The ICS gain may be dependent on the L9907 device configuration. In details, the current sense amplifiers (gain 1 and gain 2) are configured in CMD0 of L9907 plugin.

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		The ICS gain parameter must be calculated automatically using the amplification value configured in L9907 plugin.
404703	Defect	The ICS_CTU_Init function configures the CTU module for current sensing. The following DMA configuration must be moved in the microcontroller initialization phase: DmaMux_SetChannelRouting(pLocalDParams->DmaChannel,(uint8)0x0B,(uint8)STD_ON, (uint8)STD_OFF);
404704	Defect	The Res_CTU_Init function configures the CTU module for Resolver. The following DMA configuration must be moved in the microcontroller initialization phase:
404856	NewWork	Starting with the L9907 smart power device functionalities, a diagnostic management could be developed. The FS_FLAG (Fault Status Flag Output) can be monitored inside the SafetyTask to check if any fault occurs. The DIAG/DIAG2 registers could be read to get the faults occurred and send this information to the library/live monitor.
406420	Defect	The build process of the Motor Control suite contains several warnings. They should be removed.
406567	NewWork	The MISRA check should be executed on the Motor Control Library. The violations should be removed if possible or justified.

1.33 Potential Effects of bug fixes on Functionalities

N/A since non regression tests are successful run.

2. Host PC system requirements

2.1 Supported operating systems and architectures

- Windows® XP: 32-bit (x86)
- Windows® 7: 32-bit (x86), 64-bit (x64)
- Windows® 8: 32-bit (x86), 64-bit (x64)

2.2 Software requirements

The Java Run Time Environment needed for SPC5 Motor control live monitor will be automatically installed.

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3. References

All reference and documentation can be found inside the package release or at the project codex space:
https://codex.cro.st.com/projects/adg-micro-sys-sw/

4. Glossary and acronyms

Term	Description
API	**A**pplication **P**rogramming **I**nterface
CR	**C**hange **R**equest (Product Enhanced Request)
DOS	**D**ocument **O**bjective **S**pecification
ER	**Er**ror (Bug fixing Request)
eSCI	**E**nhanced **S**erial **C**ommunication **I**nterface
FOC	**F**ield **O**riented **C**ontrol
HW	**H**ard**w**are
ICS	**I**solated **C**urrent **S**ensor
IDE	**I**ntegrated **D**evelopment **E**nvironment
MCU	**M**icro **C**ontroller **U**nit
MCTK	**M**otor **C**ontrol **T**ool**K**it
MTPA	**M**ax **T**orque **P**er **A**mpere
FF	**F**eed **F**orward
FW	**F**lux **W**eakening
OS	**O**perating **S**ystem
RAM	**R**andom **A**ccess **M**emory
RLA	**R**egister **L**evel **A**ccess
SPI	**S**erial **P**eripheral **I**nterface
SW	**S**oft**w**are
SWD	**S**oft**w**are **D**river