Release Notes

Aries Operating System, revision 3.33

For use with Aries drive products

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Revision 3.33 (06-18-12)

Fixed:

- Fixed a bug with 7D encoders for speeds above 50rps

- Fixed a bug where CMDDIR could not be changed when using a Smart encoder.

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Revision 3.32 (02-21-12)

Change:

- Change RSMODE default from 0 (auto detection) to 1 (RS 232).

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Revision 3.30 (08-12-11)

Fixed:

- Fixed a bug with ISIN command. Expanding ISIN minimum from -4 to -10.

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Revision 3.29 (08-25-10)

Fixed:

- Fixed a bug which could cause OHALL 4 to be not functional.

- Fixed a bug which could cause 18 bit or higher resolution multi-turn absolute encoder not working well with ACR9000 controller.

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Revision 3.27 (04-16-09)

Changed:

- If the drive is set to RS232 mode (RSMODE1), it will no longer change modes to RS485 if it detects bad characters (bad start/stop bits) in the character stream.

Fixed:

- Fixed a bug which could cause the drive to stick in RS485 communication mode if the drive detected bad characters and switched modes to from RS232 mode. **NOTE: Powering up or down a PC while connected to a drive could cause the drive to switch to RS485 mode if the drive is powered on. If this occurs, power-cycling the drive will cause it to revert to RS232 mode.**

- Fixed a bug in velocity mode using a linear motor, which meant that the commanded velocity was wrong by a factor of the linear motor pole-pitch.

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Revision 3.26 (12-10-08)

New Features:

- *Integral Delay:* The SGINTE(P241) and INTDTM(P242) commands have been added which together add an integral delay feature when using step and direction mode (DMODE 6 or 7). SGINTE1 enables the integral delay feature and SGINTE0 disables it (ie integral gain always applied, never delayed). When enabled (SGINTE1), the integration portion of the position loop will be disabled while incoming pulses are present. Once the INTDTM value times out, the integral gain will take effect. The units for INTDTM are milliseconds. The default is SGINTE0 and INTDTM10. The range for INTDTM is 2-10000 ms.

Changed:

- If the drive auto-detects RS232 mode (RSMODE0) and sees more than 10 bad characters (bad start/stop bits) in 20 seconds, then it will automatically switch to RS485 mode. This should avoid any mis-detection of RS232/485 mode on power-up of the drive. The drive will still auto-detect communications after a power cycle with RSMODE0.

- Raised maximum values of SGP,SGI,SGPV and SGIV to 100000 (previous maximum value was 1000).

- Raised maximum values of SGDand SGV to 20000 (previous maximum value was 200).

- Re-commutation of the motor occurring after a drive mode change is now done when the drive is disabled for the mode change rather than upon enable, thus making the enable process faster (most noticeable when using a 'Q' option encoder).

Fixed:

- The drive now self-determines whether the index pulse is at 0 or 180 electrical degrees for the 'Q' option encoders. Refer to TB468 for details.

- Fixed a bug when in velocity mode and SGP or SGI were modified, their values would not be retained after a reset.

- Fixed a bug when in step & direction mode and using a high power drive (2kW/3kW), the position loop

gains would be inconsistent between various power levels and motor types. **NOTE: Due to this change, upgrading your firmware revision may cause some of the position loop gains to change slightly when using a large motor or a linear motor <u>and</u> a 2 or 3 kW Aries drive.**

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Revision 3.23 (09-17-08)

New Features:

- *P239 Command:* The P239 command has been added, which modifies the auto-run behaviour. When P239=0 (Default), enabling auto-run will turn the motor clockwise at 1rps, as before. Setting P239 to 1 will cause the motor to turn 2 revolutions clockwise, then 2 revolutions counter-clockwise. This is useful for linear motors, where the original functionality could cause the motor to reach the end of travel fairly quickly. Note, the first motion should be clockwise when P239=1.

Changed:

- The drive will now flush the input character buffer completely if a bad character is detected. Previously it would just discard a bad character, but keep the input buffer contents (which get processed when the carriage return is seen).

- The revision reportback on power-up is now preceded by an asterisk on each line of the reportback. This should prevent any other units connected erroneously responding to the revision report after a power-up or reset.

- Parameter values are now reported to 4 significant figures instead of 3 decimal places.

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Revision 3.20 (01-15-08)

New Features:

- *ISIN Command:* The ISIN command has been added, which allows user-interpolation of the absolute encoder. eg ISIN1 will double the perceived encoder resolution. The range is -4 (divide by 16 (2^{-4})) to +10 (multiply by 1024 or 2^{10}). The default value is no interpolation (ISIN0).

- *NPRK Command:* The NPRK command has been added to allow the use of non-Parker absolute encoders. If NPRK is set to one (NPRK1), then the motor parameters will not be read from the absolute encoder, and the drive's pre-existing motor configuration will be used. The default value is 0 (read the configuration from the encoder).

- *LOCK Command:* The LOCK command has been added in order to enhance the troubleshooting capability when using hall-less commutation. Setting LOCK1 will lock the rotor for 2 seconds upon enable, before allowing the motor to be controlled. ie No wake and wiggle will be performed, just the locking of the rotor to fix the commutation angle.
  NB: LOCK1 will provide a very reliable hall-less commutation at the expense of more shaft movement upon enable (up to a full motor pole). LOCK0 is the default value.

- The enable LED is now flashed at 8Hz when the drive is in current foldback mode.

Changed:

- *ENCFT Command*: The default value of the ENCFT has been set to 0. This disables encoder fault detection. For applications with no motor thermal switch (the usual way of detecting a broken feedback cable), or an application that commands torque at zero speed, this value can be enabled. The maximum value of the ENCFT command has also been raised from 10000ms to 20000ms.

- The number of consecutive valid hall sensor reads before determining that the attached motor has hall-effect sensors has been increased to 500.

- If the drive experiences an error reading the motor parameters from the smart or absolute encoders, the drive will no longer reset the motor parameters to 0. The previously existing parameters will be used instead.

- If the drive experiences an error reading the smart encoder, the drive will now default to a standard encoder. This was implemented to prevent cases where noise would cause an incorrect detection of a smart encoder when a standard encoder was present, causing the motor parameters to get reset.

- The inrush-current bypass relay is no longer closed during drive initialization.

Fixed:

- A bug when using the absolute encoder which could cause misalignment in certain encoder positions.

- A bug with the PSET command when using CMDDIR1 and an absolute encoder which could cause incorrect encoder counts after a reset.

- A bug which could cause incorrect speed calculation when using the absolute encoder and CMDDIR1.

- A bug which caused the torque angle not to get set correctly when using OHALL3 (z-channel commutation) and a smart encoder.

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Revision 3.11 (08-04-06)

- *TPARM Command*: Added TPARM(X26) command which prints out a list of all 'P' parameters and their current value. This command can be used
to take a snapshot of the current operating parameters.

- *TPRA Command*: Added TPRA(S68) command which returns the absolute position as reported by the resolver.

- Added ENCFV(P229) and ENCFT(P231) commands to support encoder loss detection. Drive will fault with encoder loss fault (E54) if no encoder change
is registered and input voltage is >ENCFV for ENCFT ms. Default for ENCFV is 7V, range is 0-10V. Default for ENCFT is 1000ms, range is 0-10000ms.

- *Absolute encoder*: Now allow use of CMDDIR1 with Heidenhain absolute encoder option. The SSI

encoder output is inverted in this case.

- *Absolute encoder*: An encoder offset value is now stored in the Heidenhain absolute encoder. PSET command can be used to set the datum point.
  After a reset the offset is then stored in the encoder. The absolute value is then the same whether CMDDIR is set to 0 or 1.
  eg To set the current motor position to 1000, set PSET1000 then issue a RESET. That motor position will be 1000 irrespective of whether CMDDIR is 1 or 0.

- Drive will now fault with E54 (Encoder Loss) during auto-commutation if no encoder is detected (signified by both encoder phases being close to 0 volts).
  This Fault (E54) is signified by a new sequence of 5 green flashes and 1 yellow of the upper LEDs. An encoder loss fault will also occur if no encoder
  movement is detected during the final auto-commutation move. This should also detect loss of motor connection.

- The drive will now flash the lower LEDs green and red at approximately 2Hz during auto-commutation.

- Modified resolver position commutation to match Gemini drives for odd pole-pair motors.

- Lowered minimum voltage before drive will enable from 110V to 90V.

- *SFB command:* The SFB command now returns a '4' for the Resolver option (same as the Gemini drives).

- Auto-run speed is now ramped as well as the motor current to improve auto-run synchronization with high pole count motors.

- *PGAIN/IGAIN commands:* If PGAIN and IGAIN current loop values are set to 0 and IAUTO is also set to 0, the drive will now automatically set IAUTO to 1 and use
  gains derived from the DIBW setting.

- *RESET command*: Changed RESET command so it will not reset the drive if a resolver error is present. The RESET command will fail with the reportback
  'ERROR: Resolver Error - Power-Cycle required' if an attempt is made to do a software RESET with a resolver error present.

- *ALIGN command:* Fixed bug which meant that if the motor alignment was close to 180 degrees, the alignment routine may fail and return an incorrect alignment.
  This issue mostly affected the use of the ALIGN command with Trilogy motors.

- *Current Null calculation:* The current null calculation routine has been improved to allow for a wider tolerance in the drive hardware. This should prevent
  an issue where the drive may take several tens of seconds to enable.

- Fixed bug which caused velocity loop to go slightly unstable when commanded to go faster than the DMVLIM value in velocity mode.

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Revision 3.10 (02-03-06)

- Added support for Resolver version of Aries:

  TREV command: TREV reportback will add 'Resolver' to the reportback. e.g. 'Aries OS Revision 3.10' has become 'Aries Resolver OS 3.10' in resolver versions.

  ERES command: fixed to 4096 for Resolver option.

  SFB command: fixed to 3 for the resolver option.

  Resolver fault: If a resolver fault is detected (e.g. signals are too low), the drive will fault with 'E51 - Resolver Error'.

  ALIGN command: The ALIGN command can be used to align the resolver. ENCOFF contains the resolver offset.

- *ERES Command:* Changed reportback for absolute encoders so that ERES reports 131072 instead of 128.

- Increased the upper range value of the following parameters to 400rps: DMTW, DMVLIM, DMVSCL, SMVER

- Fixed bug with the intertia detection algorithm which caused incorrect intertia detection with linear motors.

- Improved Hall-less commutation algorithm: Now doesn't send out encoder pulses while commutating. Added two new parameters:

  SGHD: Damping factor. Used to limit twitching. Default value is 0 (was 1000 in the previous Release Note). Range 0-32767. Higher values provide more damping, but excessive values can cause instability.

  SGHP: Peak current level. Used to specify peak current level during commutation. Range 100-32767.
  32767 corresponds to 32767/32768*Peak current. Default value is 8192 (0.25 * Peak).

- Added E50 to signify Flash Write Error. This is a warning only as it will not affect drive operation. Use ERROR or STATUS commands to check this warning.

- Added TIDAC (S64) and TIQAC (S66) commands to report actual 'd' and 'q' quadrature currents in Amps.

- P137 now sets the integral limit for the current loop to a multiple of the Bus voltage. The default value is 1. This value can be varied from 0 to 4 times the Bus Voltage.

- Added extra hall checking to detect hall error when running in Hall Only mode. Now checks for invalid hall transitions as well as hall states 0 and 7.

- *ALIGN command:* Enhanced ALIGN command so that alignment is possible with only hall-states available. Use *OHALL1* in conjuction with the ALIGN command in DMODE3 for this functionality.

- Fixed bug with UART code where there was a slight chance a random command could get mis-read if a stream of commands was sent down rapidly.

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Revision 3.02 (07-14-05)

- *OHALL Command:* Added hall-less commutation option for Aries. OHALL4 now commutates without using hall-sensors. The motor will twitch
on enable for up to 2 seconds, before enabling. HGAIN is a gain setting for the speed of the twitch. A lower value increases the speed of
commutation. A higher value decreases it, but should be more accurate. The HGAIN range is 1-40, default 3 (was 10 in the previous Release Notes).

- *SFB command*: Added auto-detection capability for absolute encoders (SFB6). Now there is no need to send SFB6 for the absolute encoders.
Just set SFB1 and the drive will auto-detect (default mode after RFS).

- Support for single-turn absolute encoders has been added in this release. The output is SSI compatible and is right-justified, 32-bits wide,
of which 17 is encoder information and gray-code formatted. The following commands should be used on the ACR9000 to read the information:

   ENC*n* WIDTH31
   ENC*n* LIMIT 17 (use 29 for multi-turn absolute encoders)
   ENC*n* CLOCK 0
   ENC*n* DST0
   ENC*n* SRC3

   where *n* is the axis the Aries is attached to.

- *RSMODE command*: Added RSMODE command to allow user to bypass RS232/485 autodetection (in certain cases when using
multiple drives (>4) with RS485, the autodetection may fail.

   RSMODE0 : Autodetect communication (default)
   RSMODE1 : Force RS232 mode (requires a reset)
   RSMODE2 : Force RS485 mode (requires a reset)

   After an OS upgrade, the RSMODE parameter gets set to 0. An OS upgrade must be performed using RS232.

- *VELLCK command*: Added VELLCK parameter which allows a user to lock the motor shaft at a position when 0 velocity is commanded.
   VELLCK0 has no lock - shaft is 'pliable' at 0 velocity (default mode).
   VELLCK1 - shaft is locked at zero velocity (similar to running in position mode).
   Caution: A position loop should not be closed around the velocity loop with VELLCK1.

- *TANOFF command:* Added TANOFF command which reports the analog offset voltage (in volts).

- The Aries Support Tool velocity tuner now reflects the SMAV value in the commanded velocity. Previously the commanded velocity
would show a step change and ignore the SMAV setting for commanded velocity.

- Fixed a bug which prevented enabling the drive after a mode change in certain situations.

- Fixed a bug which caused alignment routine to go continuously if the motor is moved before performing the alignment.

- Fixed a bug with the Current Foldback routine which caused it to engage slightly too late.

- Now open the bypass relay when the drive is disabled to limit the inrush current if motor AC power is lost then reapplied while using control power.

- Fixed a bug in the alignment code which could cause the angle to be incorrectly calculated in certain conditions (if 0 electrical degrees was within 50
encoder counts of a hall transition)

- Fixed a bug which limited step/dir input to around 500kHz. The input will now handle up to 2MHz.

- Fixed a bug which caused the drive to fault with 'low voltage on enable error' if enabled on power-up and DRES was not equal to ERES and DMPSCL0.

- Fixed a bug with the single turn absolute encoders which would cause encoder count not to wrap around after 20 shaft rotations.

- Fixed a synchronization problem between Aries and ACR update rates when using SSI interface which caused 'beeping' at regular interval.

- Fixed a problem with reading latest Heidenhain encoders.

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Revision 3.01 (04-11-05)

- Fixed bug with standard encoder commutation which could cause Hall Error fault if drive powered up disabled, and motor
moved by hand before enabling the drive.

- Fixed problem with Aries drive entering download mode when connected to an ACR9000 and drive reset via ACR9000.

- Now add 2ms delay before sending RS485 transmissions. This is to give more time for RS485 dongles to switch from transmit
to receive mode and extend compatibility.

- Fixed bug which would cause lockup if SFB6 selected. (Drive would recover after power-cycle).

- Now perform check to see if a significant OS upgrade was performed (eg 2.10 or previous to 3.01) and if so, an RFS is performed.

- Optimized flash memory access to eliminate mode switching from 8-bit to 16-bit.

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Revision 3.0 (02-18-05)

- **NB: It is essential an RFS is performed after upgrading to this operating system to allow all the new parameters to be**
  initialized. This will require re-downloading the motor configuration afterwards for non-smart encoder motors.

- Added velocity and current loop tuner functionality. Use Aries Support Tool 3.0 or later to take advantage of this feature.

- Added support for Absolute encoder option. Set SFB to 6 to use this encoder. The Aries will output SSI compatible encoder
  information from the Encoder-out port in this case. The output is right-justified, 32 bits-wide, of which 29 is encoder information,
  and gray-code formatted. The clock rate should be at least 1MHz (ideally around 1.5MHz) for best performance. This information
  is updated every 62.5us.

- Improved noise filtering on Hall effect inputs to use 20 averages to get Hall value instead of 10.

- *OHALL command:* Added OHALL3 option which uses 'Z' channel for commutation when using the smart encoder.

- *Smart Encoder:* The smart encoder now has added noise filtering. If a commutation error is detected, it will switch to z-channel
  commutation for extra noise immunity. OHALL will return a 3 if this occurred. OHALL will remain 0 after a reset however.

- *ENCFLT* command: The encoder input frequency has been reduced to 1.02MHz for rotary motors and 2.67MHz pre-quad for linear motors.
  Setting ENCFLT to 1 sets the encoder input frequency to 2.67MHz for all motors.

- Added P51 (IAUTO) and P52 (DIBW) commands. The Aries drive now supports Auto-current loop tuning in addition to P58, P60.
  To turn on Auto-tuning PI loop, Set IAUTO to 1 to enable auto-tuning PI. Default is on. DIBW is the bandwidth in Hz.
  Default is 1000 and should work for all motors. This new mode should provide enhanced performance for all motors.

- Added support to detect lack of mains voltage for low-power Aries (up to 750W). If the drive detects a lack of AC mains voltage upon enable, the drive will fault with a
  'low voltage at enable' fault. If DC is being used to run the drive, set P165=1 to work-around this detection algorithm. The default value is P165=0.

- Improved speed of ALIGN command to reduce wait between each move. E49 (Alignment Error) can now be used to check if the Alignment was successful.

- Fixed bug where STATUS command would report incorrect feedback type.

- Fixed bug with parse routine where some negative floats would give incorrect value (most noticeable with DCMDZ command).

- *ALIGN* command: Fixed bug in alignment code which could cause motors to mis-align by up to 30 degrees when the alignment
  was in a certain 100 encoder-count band.

- Fixed bug with FLTDSB0 where fault-output would not be activated if powered up into a fault.

- Fixed bug which caused brake output to latch open intermittently if drive was enabled and disabled rapidly (<0.5s).

- Fixed bug which may cause loss of configuration parameters under certain conditions: Rapid power cycle (applying and removing power within 2 seconds)

or removing power within 1 second of a fault condition could cause the parameters to be lost on the next power-up.

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Revision 2.10 (07-27-04)

- *STATUS command:* Fixed bug with STATUS command which could cause drive to hang.

- *Smart Encoder:* The smart encoder now stores DMTLIM,DMTSCL,DTHERM and thermal switch type values in the encoder.

- *IANI command:* Added IANI command (P53) to invert analog input if desired. Default value is 0 (do not invert input). Set IANI to 1 (IANI1) to invert the analog input.

- *OHALL command:* Added OHALL (P96) command for hall-only commutation. Use OHALL1 to use trapezoidal (hall-only) commutation. This command requires a reset to work.
  Default value: 0 (encoder commutation). This command only works with a standard encoder.
  OHALL2 can be used for brushed DC motors. Wire motor to phases U&W in this case.

- *Smart Encoder:* If the drive is disabled whilst in DMODE3, then with the Smart Encoder, the current Hall state will be constantly updated and can be read via the THALL command.

- Added support for normally open switches and NTC thermistors via P118 (DMTSWT):
  P118 = 0: Default, normally closed switch.
  P118 = 1: PTC thermistor (acts like P118=0).
  P118 = 2: Normally open switch.
  P118 = 3: NTC thermistor. TMTEMP will report the higher of the motor thermal model value or the calculated thermistor temperature once the thermistor temperature
  is above 60C. Drive motor temp faults at thermistor temp of 105C or Motor Thermal Model setpoint with P118=3.

- *INPOS command:* Modified InPosition output so the algorithm waits at least INPOSTM time without any new pulses before setting the in-position output.

- *SFB command:* If SFB is set to a value not equal to 1, the drive will assume SFB has been set to a correct value and NOT auto-detect the encoder type. For this reason, the default
  SFB value of 1 is now Auto-Detect.   A standard encoder is now SFB2. 'Q' is as before, (SFB5) and a sincos encoder is SFB6 as before. Note: you must explicitly type the SFB
  value into the terminal for it to not use auto-detect, otherwise it will only report back the detected encoder type after running the auto-detection code.

- *DRES command*: Added DRES command for step and direction inputs. Input steps will be scaled to DRES value so DRES steps on the input would translate to 1 revolution of the motor.
  DRES is set to ERES internally if DMPSCL is non-zero for backward compatibility. DMPSCL should be set to 0(new option) to enable DRES support.

NB: DRES change requires a reset to take effect. DMPSCL works immediately so you COULD use DMPSCL0 to enable DRES support then enable DMPSCL and have both features working at once.

- Increased filtering on encoder inputs to limit them to 2.7MHz pre-quad. Should help noise immunity.

- Increased filtering on Hall Inputs with the aim of increasing noise immunity.

- Fixed bug which could cause SERIAL and DMTR commands to function incorrectly when using addressed drives.

- Fixed bug which caused current command to be delayed by one update period.

- Fixed bug which caused current loop gains to be slightly lower when going in clockwise direction at high speed.

- Fixed bug which allowed drive to enable if DTHERM1 was set and no feedback was connected.

- Fixed bug where Hall Errors and Encoder Failures weren't latched. They now require a reset before the drive will re-enable.

- Fixed bug which prevented left-most bit of ERRORL mask being set.

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Revision 2.00 (11-04-03)

This is the first release of the operating system for the Step&Direction version of the Aries product line.

- *Velocity mode:* The analog version of the Aries is now able to run in velocity mode (DMODE4). For more details see the user guide.

- *Smart Encoder:* Fixed bug which could cause an initial commutation error with the 'Q' option motors causing the motor shaft to jump when the drive is enabled.

- *ANICDB command:* Improved the way in which the ANICDB command is implemented so that once out of the deadband torque is applied linearly from zero and doesn't perform step change.

- *DMTSCL command*: The DMTSCL command is now stored in the Smart Encoder and so can be modified and saved in the motor instead of being set to the DMTLIM parameter.

NB: If you are upgrading from a previous operating system you MUST perform a 'Return to Factory Settings' after updating the operating system.

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Revision 1.01

- *TVELA command:* The velocity measurement routine has been improved to reduce phase-lag and variation.

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- *Keep-alive:* The keep-alive voltage threshold has been increased to 85V from 40V.

- *LEDs:* The LEDs now give 4 flashes for 'other' fault instead of red&yellow solid LEDs. Keep-alive mode is now indicated by red&yellow solid LEDs.

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Revision 1.00

This is the first release of the operating system for the Aries product line.