



RTC5 Software – Revision History (as of 2024-09-27)

Current Software Package: RTC5 Software 2024 09 27.zip

RTC5DRV.sys	6.1.7600.16385	2012-06-23
RTC5DAT.dat	500	unchanged
RTC5RBF.rbf	534	changed from 533
RTC5OUT.out	553	changed from 552
RTC5DLL.dll	551	changed from 550

Notation:

B	Bugfix
C	Change
N	New

Firmware RTC5RBF.rbf Version 506 to Version 507

N: Equidistant external starts	set_control_mode and set_control_mode_list (bit #10 = 1) allow track delays to commence counting from the time point of the last external list start (triggered via simulate_ext_start or an external start signal). This way, equidistant external list starts can be created that are independent of the time point of the start trigger as long as they occur within the specified track delay. In contrast, bit #10 = 0 (default) causes track delays to commence counting at the time of the start request.
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Firmware RTC5RBF.rbf Version 507 to Version 509

(intermediate version 508 wasn't an official release)

C: SL2 transfer	508: With a disconnected scan head, the firmware didn't forward any error bits. Now the pulse length error bit is forwarded (see get_startstop_info, bits #17 and 25), thus allowing disconnected scan heads to be identified at runtime.
B: Softstart, pixel mode	508: Under some circumstances the first pixel was incorrect. The most recently set pixel value (default pixel) was always applied.

B: Laser delays	<p>Newly written LaserOn or LaserOff delays were ignored if a prior delay hadn't yet expired.</p> <p>Example of this error situation: Mark1-Jump1-Mark2-Jump2 combinations with LaserOn/Off delays so large that Mark1's LaserOn delay hadn't yet expired during Mark2 or Jump1's LaserOff delay hadn't yet expired during Jump2. In such cases, the second delay was always ignored. Therefore, even after a set_end_of_list (in place of Jump2), for example, the laser would have actually remained on.</p> <p>Now delays are overwritten. Thus, Mark1's LaserOn delay and Jump1's LaserOff delay would be "ignored." Accordingly, the laser will always actually be off after set_end_of_list. Also see bugfix DSP program file version 511 to version 512.</p>
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Firmware RTC5RBF.rbf Version 509 to Version 511

(intermediate version 510 wasn't an official release)

N: set_laser_mode(6)	see manual version 1.0.
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Firmware RTC5RBF.rbf Version 511 to Version 512

B: encoder reset	The encoder reset always occurred with an external /START, even if the external /START was suppressed while a list was active.
C: master/slave	Improvements of master/slave initialization.
N: sync_slaves	Resynchronization of master/slave chain.
N: laser control	Counter for external pulses at DIGITAL_IN1, see DLL version 514 to version 515 or DSP program file version 513 to version 514.
C: set_laser_control	Bit #5: polarity of external pulses at DIGITAL_IN1.

Firmware RTC5RBF.rbf Version 512 to Version 513

B: rs232_read_data	external data synchronization error resolved.
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Firmware RTC5RBF.rbf Version 513 to Version 515

(intermediate version 514 wasn't an official release)

C: sync_slaves	Improved synchronization of master/slave chain.
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Firmware RTC5RBF.rbf Version 515 to Version 516

B: ANALOG OUT1	With the very first laser pulse after load_program_file the ANALOG OUT1-Voltage was reset wrongly.
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Firmware RTC5RBF.rbf Version 516 to Version 517

B: LaserOn and LaserOff delays	Refinement of the laser delay's control, see RTC5OUT.out Version 521 to Version 524.
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Firmware RTC5RBF.rbf Version 517 to Version 518

(intermediate version 518 wasn't an official release)

C: Encoder reset	Both encoders can be separately reset (see set_fly_x, set_fly_y).
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Firmware RTC5RBF.rbf Version 518 to Version 519

C: get_marking_info	If one or more of the status word bits are set for monitoring via set_laser_control, any possible error can be read out via get_marking_info.
B: simulate_ext_start	Other than documented, a simulated external start within an activated debouncing time has been prevented.

Firmware RTC5RBF.rbf Version 519 to Version 520

N: set_pulse_picking, set_pulse_picking_list	Laser control with Pulse Picking Mode.
B: Pixel mode	If the first pixel after load_program_file had the value 0 this analog value wasn't output, provided another value had been explicitly written to the AnalogOut channel previously selected via set_pixel_line.

Firmware RTC5RBF.rbf Version 520 to Version 521

(intermediate version 521 wasn't an official release)

C: set_pulse_picking, set_pulse_picking_list	If No = 0, the LASERON signal is output as LASER2 signal.
N: Output synchronization	Synchronization of the galvanometer's output with the incoming pulses of an external free running laser.

Firmware RTC5RBF.rbf Version 521 to Version 522

B: set_fly_...commands	The encoder counters didn't reset sometimes.
B: Encoder counters	The encoder counters didn't count sometimes, if the encoder pulses were simultaneously connected to several boards.
B: stop_execution and external /STOP	Sometimes the laser was switched on again after the stop.
C: Output synchronization	Synchronization also with Pulse Picking signals, minimal incoming pulse length 125 ns.

Firmware RTC5RBF.rbf Version 522 to Version 523

N: get_sync_status	Measurement of a SLAVE-board's synchronization status.
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Firmware RTC5RBF.rbf Version 523 to Version 524

C: Laser signals in general	The laser signals LASERON, LASER1, LASER2 and the FirstPulseKiller signal can be freely redirected to the laser connector pins 1, 2 and 9 (config_laser_signals).
C: Pulse Picking Mode	A constant pulse length can be programmed for the pulse picking mode (set_pulse_picking_length).
C: set_laser_control	Provided, the pulse picking mode is switched on, Bit #7 = 1 activates the constant pulse length mode.

Firmware RTC5RBF.rbf Version 524 to Version 526

(intermediate version 525 wasn't an official release)

B: Track delay and external encoder signals	When the track delay expired, sometimes two start triggers with a time delay of 10 μ s have been created.
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Firmware RTC5RBF.rbf Version 526 to Version 527

(intermediate version 526 wasn't an official release)

C: Output synchronization	Now laser frequencies down to 50 kHz are supported.
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Firmware RTC5RBF.rbf Version 527 to Version 528

B: Output synchronization	control_command was handled like a normal output signal.
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Firmware RTC5RBF.rbf Version 528 to Version 529

B: Laser control	Under certain circumstances, the laser remained switched on during a jump.
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Firmware RTC5RBF.rbf Version 529 to Version 533

B: Output synchronization	Special timing conditions could lead to one missing LASER1 pulse.
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Firmware RTC5RBF.rbf Version 533 to Version 534

B: ANALOG OUT 1/2	Fix linearity error for analog outputs.
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DSP Program RTC5OUT.out Version 510 to Version 511

B: get_marking_info	Processing-on-the-Fly application: image field overflow detection was faulty, get_marking_info always returned "OK."
B: arc_abs, arc_rel	Sky-Writing: under some circumstances the starting point was incorrect.
B: mark_date, mark_time, mark_serial	Undefined characters sometimes caused a program hang. They are now ignored (as is already the case with mark_char and sub_call). mark_time wouldn't fully execute if the command wasn't issued twice.
B: /START	List starts externally triggered within 10 µs after a set_end_of_list would cause a program hang. This has now been fixed.
C: get_startstop_info	The return value now contains in the upper 16 bits the SL2-100 transferred error bits.
C: set_control_mode, set_control_mode_list	Bits #12-15 are now reserved. The suppression of /STOP is no longer supported.
B: list_jump_rel_cond, list_jump_pos_cond	Jump commands initiating a jump to themselves failed to function.
C: set_auto_laser_ctrl	Mode = 5 allows laser control dependent on the encoder speed.
N: set_encoder_speed, set_encoder_speed_ctrl	Defines the target encoder speed for automatic laser control with mode = 5.
N: switch_ioport	Expansion of list_jump_..._cond commands. Branching to N (>1) addresses via selectable bits of the 16-bit I/O port.
C: set_control_mode, set_control_mode_list	Mode bit #10 is now handled (see Firmware version 506 to version 507, N: equidistant external starts).

DSP Program RTC5OUT.out Version 511 to Version 512

B: mark_date, mark_time, mark_serial	The command didn't function properly in every situation, e.g. in "suppress leading zeros" mode.
C: mark_date	Months and weekdays can now also be marked with normal digits (parameter parts = 6, 7).
B: Softstart	Softstart wasn't activated.
C: Softstart	After expiration of the power-off waiting time, the value for Index = 0 will be issued (RTC®4 compatibility).

B: Laser control	For very large laser delays extending across a Mark-Jump or Jump-Mark change, appropriate scanner delays will be inserted to prevent overlaps with not-yet-expired laser delays (the example error situations for Firmware version 507 to version 509, B: laser delays are thereby avoided). Laser switchoff during polygonal traversal with sharp corners (EdgeLevel parameter in set_delay_mode) will only occur if the laser was already on during this polygonal traversal (i. e., when the LaserOn delay has already expired and no LaserOff delay remains active).
C: simulate_ext_start, set_ext_start_delay_list	These are now normal commands instead of short list commands (otherwise conflict with set_control_mode_list possible)
N: set_offset_xyz, set_offset_xyz_list	An offset is now also specifiable for the Z axis (direction opposite set_defocus).
C: set_trigger, get_value	Parameters 20-23 return the final output values (incl. gain/offset).
C: get_value	Parameter 0 also returns the current laser status from outside a list execution.
C: get_head_status	Reserved bits are now returned as 1 (as is already the case with get_value and set_trigger).

DSP Program RTC5OUT.out Version 512 to Version 513

B: set_laser_control	Laser hardware was enabled too early: For low-active polarities, LASERON could be active for some microseconds.
B: set_offset, set_offset_list	Z coordinate drove up to the limit stop (this occurred only in version 512, but not with set_offset_xyz or set_offset_xyz_list).
C: set_fly_...	set_fly_...with an unallowed parameter value always deactivated all fly corrections (Example: set_fly_x(Kx); set_fly_y(0) also deactivated the set_fly_x-correction, on the other hand set_fly_y(0); set_fly_x(Kx) operated successfully). Now a fly command with unallowed parameter value only deactivates the fly correction, previously activated via the same command with allowed parameter value (example: now set_fly_y(0) only deactivates a fly correction previously activated via set_fly_y(...), set_fly_rot(0) only deactivates a fly correction previously activated via set_fly_rot(...)).
C: McBSP interface (SPI/I ² C connector)	Data of the McBSP interface will not be continuously retrieved any longer. Data will be retrieved only while a list is executed and if a Processing-on-the-fly application with usage of McBSP position data has been activated.

N: get_mcbasp_list	Queries data from the McBSP buffer (once), in order to make way for the current data transfer (see McBSP interface).
N: get_overrun	Returns the number of 10µs clock overruns which occurred since the last call of get_overrun (see manual version 1.0).
B: laser_signal_on, laser_signal_on_list	Under some circumstances, only the LASERON but no LASER1 signal and no LASER2 signal were output.
B: mark_serial, mark_serial_abs	M ₂ = 1 did not work, the serial number was always incremented after marking (as via M ₂ = 0).
B: simulate_ext_start	Was disabled via set_control_mode(bit #0 = 0) as the external start input (via /START, /START2 or /Slave-START). Now the command is always allowed.
B,C: goto_xy, goto_xyz	B: Were not executed (without any error message!), if an external stop signal (/STOP, /STOP2 or /Slave-STOP) was low. C: (Deliberately) will not be executed (get_last_error return code: RTC5_BUSY), if an external stop signal is low.
B: home_position	A home jump was not executed, if an external stop signal was low longer than approx. 10 µs. Now, a home jump is always executed and cannot be stopped via an external stop signal.
N: home_position_xyz	Enables home jumps also for the Z axis.

DSP Program RTC5OUT.out Version 513 to Version 514

B: Encoder-Reset	See change for firmware version 511 to version 512.
N: get_standby	Return value: current standby parameters.
N: get_master_slave	Return value: master/slave status of the addressed board.
N: simulate_ext_start_ctrl	Analog to the list command simulate_ext_start, this new control command simulates an external start, but without track delay definition.
N: Fast RTC®5	Identification and settings for faster RTC®5 boards.
B: get_marking_info	ENCODER error bits were shifted to the left by 8 bit.
N: sync_slaves	Stably synchronizes the slave boards' 10µs clock phase with the master board's 10µs clock.
N: laser_on_pulses_list	Laser control: LASERON only for a specified number of external pulses at DIGITAL_IN1, otherwise as laser_on_list.
C: set_laser_control	Bit #5: polarity of external pulses at DIGITAL_IN1.
B: laser_on_list	For Period > 1, the LaserOn period was 10 µs too short.
B: get_head_para	For 3D tables, only returned the calibration factor (since DSP program file version 511).

DSP Program RTC5OUT.out Version 514 to Version 515

B: auto_change	An auto_change command within a few µs after a set_end_of_list could cause a program hang.
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B: Softstart mode	Softstart wasn't activated at all situations and was deactivated too early at some other situations.
B: set_defocus	Didn't function for 3D correction tables without F-Theta lens.
B: Z-Axis	C value was scaled too small.
B: measurement_status	Return value Pos was too big by 1 count.
B: set_fly commands	Switched off too early (the delay has not yet expired).
B: Processing-on-the-fly	Some commands, for example list_nop, didn't propagate the galvanometer position during a Processing-on-the-fly application.
B: Pixel mode	At some situations an extra pixel had been marked.
B: rs232_write_text_list	A runtime problem on writing several chars has been resolved.
N: upload_transform	Retrieves transformation data.
N: get_values	Retrieves up to 4 signal types simultaneously, see get_value (without s) also.
C: Scanner delay	Vectors of length 0 are ignored for calculating the (variable) polygon delay.

DSP Program RTC5OUT.out Version 515 to Version 516

B: switch_io_port	SwitchNo was calculated without using Mask.
N: set_auto_laser_params, set_auto_laser_params_list	Ctrl, Value, MinValue, MaxValue can be subsequently changed (see set_auto_laser_control).
N: write_io_port_mask, write_io_port_mask_list	Only the masked bits are newly written, the other bits remain unchanged (see write_io_port).
N: timed_para_mark_abs, timed_para_mark_rel, timed_para_jump_abs, timed_para_jump_rel	Simultaneously timed and parameterized 2D commands, also see timed_mark_abs, para_mark_abs, timed_jump_abs, para_jump_abs or ~rel.
N: timed_para_jump_abs_3d, timed_para_jump_rel_3d, timed_para_mark_abs_3d, timed_para_mark_rel_3d	Simultaneously timed and parameterized 3D commands, also see timed_mark_abs_3d, para_mark_abs_3d, timed_jump_abs_3d, para_jump_abs_3d or ~rel_3d.
N: arc_abs_3d, arc_rel_3d	Linear z movement during the angular xy movement.
N: stop_trigger	Terminates data storage, when no list is currently active (see measurement_status, set_trigger).
B: Control commands with option set_verify	Sending a command a very short period of time (a few RTC®5 CPU clock cycles) before executing that command could possibly cause a not existing transfer error being reported. Neither the command's execution nor the verification of any other download was affected by this bug.

DSP Program RTC5OUT.out Version 516 to Version 517

B: list_jump_rel	Operated within protected subroutines and sub_call like list_jump_rel(delta+1).
B: set_end_of_list	The finalizing scanner delay wasn't counted by save_and_restart_timer.
B: 3D output	Changing the image field size (stretching) by a variation of z wasn't handled correctly.
B: time_fix, time_fix_f	Didn't always correctly initialize leap year and week day for mark_date and mark_date_abs.
B: select_cor_table, select_cor_table_list	Didn't execute pending coordinate transformations subsequently, when a correction table was reassigned to the scan head.
N: set_ellipse	Defines shape and section of an ellipse.
N: mark_ellipse_abs, mark_ellipse_rel	Mark an ellipse around an absolutely or relatively defined center.
N: set_sky_writing_para, set_sky_writing_para_list	Like set_sky_writing, but run-in and run-out freely adjustable.
C: get_rtc_version	New: Bits #16–23 = DSP version info.

DSP Program RTC5OUT.out Version 517 to Version 519

(intermediate version 518 wasn't an official release)

C: Short list commands	<p>518: Up to a maximum of 12 short list commands are allowed within one 10 μs cycle. The real maximum number may be reduced depending on the load of the board and the DSP version. There are still two short list commands allowed to precede normal list commands within one 10 μs cycle. Short list commands, which change the output pointer (e.g. sub_call, list_return or list_jump), count as two commands. When the maximum number of allowed short list commands is exceeded, list_nop will not be inserted any longer, instead a 10μs cycle is inserted (the laser keeps switched on during a polyline).</p> <p>For several short list commands in a row, a delayed short list command will execute undelayed only if a further delayed short list command is following, but not any longer if an undelayed short list command is following.</p>
C: Markings of length 0	<p>518: At markings of length 0 the laser won't be influenced anymore, i.e. it will stay switched off, if it's still off and it will stay switched on, if it's already on. See also DSP program version 514 to version 515: C: Scanner delay.</p>

B: set_sky_writing_para, set_sky_writing_para_list	Nprev, Npost = 0 didn't function always correctly.
C: In general: Coordinate transformations	New: at_once = 2. Collecting like at_once = 0, and executing in a shared jump together with goto_xy, goto_xyz, jump_abs or jump_rel.
B: para_mark commands	Did indeed use the wobble mode provided that it was switched on, but didn't activate it by themselves.
B: para_mark- and para_jump commands	The analog output voltages were too small by a factor of 16 (see set_vector_control: Ctrl = 1 oder 2).
N: store_encoder	Internally stores the current encoder values.
N: read_encoder	Reads out the internally stored encoder values.
B: set_wobble_mode	Incidental disturbance by a data overflow at eight-shaped wobble mode.
N: auto_cal	Command = 4: Determines and stores the ASC sensor type. Supports the new ASC sensor type 2.
C: auto_cal	After the command, the galvanometer scanners will now always be in the same position as before the command (or – if applicable – in the gain/offset corrected position), but not at their mid-positions.

DSP Program RTC5OUT.out Version 519 to Version 521

(intermediate version 520 wasn't an official release)

B: In general	Under certain circumstances – due to a timing gap – a list command could have been sporadically executed with faulty parameters. This has been fixed.
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DSP Program RTC5OUT.out Version 521 to Version 524

(intermediate versions 522 and 523 weren't official releases)

B: laser_on_list, laser_on_mask_list	522: With laser delays less than 10 µs the LASERON time was too long by 10 µs.
C: Laser delays and scanner delays in general	522: The scanner delay control was generally revised to prevent a crossover of LaserOn and LaserOff (see manual chap. 7.2.3). Therefore, an additional 10 µs scanner delay can be more frequently dispensed (RTC5RBF.rbf version 517 required).
B: get_z_distance	523: Returned wrong results since version 512.
B: Z-output for 3D systems	The Z-output to a varioSCAN could overflow, provided a blasting occurred by the use of improper ABC values (output equals 0 instead of +Zmax, not visible via set_trigger or get_value with signal SampleAZ_Corr = 12).

C: In general: Coordinate transformations	Since RTC5OUT version 519 control commands with parameter at_once = 2 initiated a scanner delay, being executed at the start of a list. Thus, using a master/slave chain, an equally timed execution of a list might be disturbed. The scanner delay will now be suppressed for control commands.
N: set_dsp_mode	This command adjusts the maximum number of short list commands within a 10µs cycle to the allowed number for a smaller CPU frequency (smaller DSP version, see get_rtc_version).

DSP Program RTC5OUT.out Version 524 to Version 526

(intermediate version 525 wasn't an official release)

B: set_fly_rot	525: Rotation angle was scaled too small.
B: rs232_read_data	526: led to an endless loop within the DSP (version 525 only).
B: arc_rel_3d	Could be possibly executed with wrong speed.
C: Timed mark vectors or arcs with zero length	Are no more short list commands, but now behave like normal vectors or arcs.
N: para_laser_on_pulses_list	Marks a parameterized discrete point.
C: SPI/I ² C interface (McBSP)	No more sticking, if more than two data words are sent to the board and no list with active "processing-on-the-fly" with position data is executing.
N: read_mcbasp	Reads a memory location of a completed McBSP transfer.
C: get_mcbasp_list	Is now an empty short list command, has no functionality any more.
N: set_mcbasp_x/y/rot, set_mcbasp_x/y/rot_list	Definition of a McBSP transfer's data words interpretation for a coordinate transformation.
N: apply_mcbasp, apply_mcbasp_list	Applies the coordinate transformation.
N: time_fix_f_off	Fixes time + offset to be marked.
B: variable jump delay	A minimal jump delay (set via set_delay_mode) larger than the ordinary jump delay (set via set_scanner_delays) could result in an excessive variable jump delay.
N: move_to	The control command controls a varioSCAN _{FLEX} Z-axis via the 16-Bit-IO-Port and a StepperMotorExtension board.
B: list_jump_rel	If the command followed a sub_call command within a list (even if it did not <i>immediately</i> follow the sub_call command) the command could have been ignored. Within a nested sub_call call, the command could have been executed faulty.

DSP Program RTC5OUT.out Version 526 to Version 527

C: set_fly...	The encoder counter reset needs an additional 10µs cycle to execute completely. This cycle is now automatically provided by the set_fly... command.
C: Marking commands with zero length (vectors, arcs, ellipses)	If the laser is switched off, it will be switched on and the command will last 10 µs to execute. Otherwise, it is a short list command and doesn't switch the laser signals. Thus, single points can be marked alternatively to laser_on_list or timed_mark....
B: rs232_write_text_list	The command always sent only the first character of the text to the rs232 interface and ignored the others.
C: set_vector_control, parametrized vectors	Parameterized vectors now can be executed with the focus shift (Ctrl = 7) as parameter type.
C: Coordinate transformations	With at_once = 3 the laser stays on during the jump (if it is on), in other respects like at_once = 1.
N: list_continue	Separation between short list commands, which in opposite to list_nop keeps the laser on and doesn't execute scanner delays.
N: micro_vector_abs, micro_vector_rel	Executes a single micro step without scanner delays, but with individually programmable laser delays.
N: set_fly_limits	Defines variable limits for Fly-Overflow detection.
N: if_fly_x_overflow, if_fly_y_overflow, if_not_fly_x_overflow, if_not_fly_y_overflow	List command to poll Fly-Overflow detection with the possibility of program branching like, for example, if_cond or if_not_cond.
N: clear_fly_overflow	Deletes detected Fly-Overflows.
C: get_marking_info	Now also returns Fly-Overflow detections with the variable limits.

DSP Program RTC5OUT.out Version 527 to Version 528

B: Coordinate transformations	The parameter at_once = 3 executed correctly only for the list commands.
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DSP Program RTC5OUT.out Version 528 to Version 529

N: Sky-Writing	Sky-Writing mode 2 available.
N: set_sky_writing_mode, set_sky_writing_mode_list	Switch the Sky-Writing mode.
B: set_fly_? commands	Even if bit #9 (reset with ext. start) has been set in set_control_mode, the set_fly_? commands did nevertheless reset the encoders.

C: set_fly_x, set_fly_y, set_fly_rot	Now these commands only reset the encoder assigned to the command, but no more both encoders simultaneously.
N: read_analog_in	PCI-Express board: Returns the voltages AnalogIn0 and AnalogIn1 after they have been digitized by the on-board AD converter. PCI board: Only applicable, if an external plug-on AD converter board (article number 121126) has been attached to the SPI/I2C connector.
C: get_marking_info	Returns the status word error bits, if a surveillance has been set via set_laser_control and if an error has occurred.
B: set_delay_mode: DirectMove3D	The z dependent XY stretching was faulty calculated for the intermediate micro steps. The values at the beginning and at the end were always correct.
B: long_delay	Delayed short list commands have executed only after a long delay command.
N: Stepper motor signals	The stepper motor signals are available now (see manual as of version 1.5).

DSP Program RTC5OUT.out Version 529 to Version 530

B: set_fly_limits	The limits have been used with a too small scaling factor.
B: Pixel mode	If the final Default pixel had not been explicitly defined the AnalogOut2 could rise up to 10 Volts, even if AnalogOut1 had been selected via set_pixel_line.
B: Vector defined automatic laser control	If the focus shift was selected via set_vector_control (Ctrl = 7) the focus shift was scaled too small.
B: set_fly commands	If the fly mode was switched off via parameter 0 (and not via fly_return) the position of the galvanometer scanners (as of version OUT529) wasn't corrected.
C: set_control_mode, set_control_mode_list	If Bit #1 is set, an external /STOP and stop_execution now also completely delete the waiting queue of not yet expired external starts.
N: set_pulse_picking, set_pulse_picking_list	Laser control with pulse picking mode.

DSP Program RTC5OUT.out Version 530 to Version 531

B: set_matrix_list	The parameter at_once was ignored.
B.: get_marking_info	The surveillance error bits for the secondary scan head weren't returned.
B: Stepper motor signals	The stepper-busy flag wasn't set. Therefore the list command stepper_wait didn't function.

C: laser_on_pulses_list	If Period > 2 ³¹ , the command will finish even before the complete wait time (Period – 2 ³¹) has expired, if the required number of external laser pulses at DIGITAL_IN1 is detected.
C: set_laser_control	Bit #6 = 1 activates the output synchronization.
N: set_fly_z	Activates a fly-z application with encoder values.
N: fly_return_z	Like fly_return, in addition it terminates a fly-z application.
N: set_fly_limits_z	Defines variable limits for fly-z-overflow detection.
N: if_fly_z_overflow, if_not_fly_z_overflow,	List command to poll fly-z-overflow detection (like if_fly_x_overflow, if_not_fly_x_overflow, a.s.o.)
C: clear_fly_overflow	Bits # 5, 6: delete Error bits # 24, 25 from get_marking_info.
C: get_marking_info	Bits # 22 – 25: show fly-z-overflow errors.

DSP Program RTC5OUT.out Version 531 to Version 532

N: get_sync_status	Measurement of a SLAVE-board's synchronization status.
N: set_free_variable[_list], get_free_variable[_list]	4 freely usable variables for set_trigger and McBSP output.
C: set_trigger	Further data types added for recording via set_trigger.
C: McBSP output	Data formats adapted to data types.
N: set_mcbasp_out_ptr	Up to 8 data types can be output circularly.
N: set_mcbasp_in	New input mode for McBSP interface.
B: apply_mcbasp	Faulty Bit #31 to distinguish between data types.
C: read_mcbasp	Now, up to 4 internal memory positions can be readout.
B: wait_for_encoder_mode	Didn't operate correctly for Mode > 0 and Wait < 0.
B: fly_x_pos, fly_y_pos	Didn't operate, if both options were used together.
N: set_mcbasp_freq	The output clock frequency is tunable between 4 and 16 MHz (Default: 8 MHz).
B: stop_execution	During a subroutine, the CallStack wasn't adjusted correctly.
C: set_sky_writing_mode	Mode = 3 available.
N: set_sky_writing_limit, set_sky_writing_limit_list	Definition of a limit value to switch between Sky-Writing modes 2 and 3.
B: Sky-Writing mode 2	Arc commands didn't function correctly in all cases.

DSP Program RTC5OUT.out Version 532 to Version 534

(intermediate version 533 wasn't an official release)

B: n_load_program_file with RTC®5-express boards	533: After the PC's warm boot the command could cause the DSP's initialization procedure to hang up (see also RTC5DLL.dll version 531 to 533). This has been solved. But now under circumstances the analog inputs at the "SPI / I2C" connector could be permanently switched off. The analog inputs would then be available again only after a cold boot of the PC.
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C: ANALOG INx with RTC®5 -express boards	533: The analog inputs at the "SPI / I2C" connector are now disabled per default at start up, but not permanently. They will be automatically enabled at the first use, unless they haven't been disabled permanently before (see above).
B: Sky-Writing	533: With every Sky-Writing mode the LASERON time was too short by 10 μ s compared to no Sky Writing mode. Thus short markings with a time duration of 10 μ s have not been marked with LaserOnShift = 0 (default value). That's changed now. To be compatible with already optimized parameters the application should add 10 μ s to the parameter LaserOnShift to compensate for the change.
B: set_mcbasp_in_list	533: The parameter Scale was applied incorrect.
N: set_pulse_picking_length	Defines a constant pulse length for the pulse picking signal, independently from the current "Laser active" pulse length.
C: set_laser_control	Provided, the pulse picking mode is switched on, Bit #7 = 1 activates the constant pulse length mode.
N: config_laser_signals	The laser control signals LASERON, LASER1, LASER2 and the FirstPulseKiller signal can be freely redirected to the laser connector pins no. 1, 2 and 9.
B: Pixel mode	Any marking command with a large LaserOn delay immediately in front of set_pixel_line didn't cause an automatic delay adjustment to be executed .
C: load_correction_file, select_cor_table, select_cor_table_list	Up to 4 correction tables can be loaded on the RTC5 board at the same time.

DSP Program RTC5OUT.out Version 534 to Version 535

N: set_fly_tracking_error	POF: Defines an encoder value dependent tracking error compensation.
N: set_mcbasp_matrix, set_mcbasp_matrix_list	Online Positioning: Specification of interpretation of the McBSP transferred data words as matrix coefficient for the coordinate transformation.
C: Sky-Writing	If LaserOnShift is larger than the upcoming marking length, the laser will not be switched on for the current command.
C: stop_execution	The command now switches off the laser, even though no list is currently active. Apart from that the command will (still) have no effect, when no list is currently active (still get_error return code RTC5_BUSY).
B: auto_cal	The command can now also be executed with external /STOP permanently active.

DSP Program RTC5OUT.out Version 535 to Version 536

N: micro_vector_abs_3d	Like micro_vector_abs, but with a 3D micro vector end point.
N: micro_vector_rel_3d	Like micro_vector_rel, but with a 3D micro vector end point.
N: set_softstart_level_list	Similar as set_soft_start_level, but a list command.
N: set_softstart_mode_list	Like set_soft_start_mode, but a list command.
N: set_delay_mode_list	Like set_delay_mode, but a list command.
N: load_fly_2d_table	Downloads an XY stage encoder compensation table (for set_fly_2d sessions only).
N: set_fly_2d	Activates a 2D fly session (for XY stages).
N: init_fly_2d	Initializes the start position of an XY stage for an encoder compensation table.
N: get_fly_2d_offset	Returns the current offset values for the encoder compensation table.
N: wait_for_encoder_in_range	Waits until both encoders fall within the given range (2D fly or XY fly sessions only).
N: set_trigger4	Allows to simultaneously record 4 channels with half of the storage space for each channel.
C: set_trigger, get_value	Signals 43 and 44 (Encoder0 and Encoder1) can be recorded and read out.
B: get_head_status	PosAck y wasn't returned.
C: set_encoder_speed	Sets the 100% value for the vector speed from both encoder channels for the encoder-speed-dependent automatic laser control.
C: Automatic laser control	New option: vector encoder speed for 2D fly or XY fly sessions.
B: Automatic laser control	The possible range was only a factor 2 instead of the specified factor 4.
B: Online-Positioning	Sometimes the coded data has been stored at the wrong position.
C: set_laser_control	Bit #28 = 1: In the case of an error, the laser-signal auto-suppression will automatically create a /STOP signal (the list stops, the laser switches off permanently).
N: load_stretch_table	Extended 3D correction (z-dependent field rectification).
N: activate_fly_2d, activate_fly_xy	Activates the fly corrections like set_fly_2d resp. set_fly_x and set_fly_y, but without an encoder reset.
N: if_not_activated	In the case of an error with activate_fly_2d or activate_fly_xy, allows a list jump, for example.
N: park_position, park_return	Jumps to a secure parking position and returns within fly correction sessions (2D fly and XY fly only).
N: repeat_list, until_list	Structured programming: Allows a numbered repetition of a group of list commands.
N: set_pixel_line_3d	Pixel mode along a 3D vector.

N: Coordinate transformations within the virtual image field	In set_fly_2d sessions only: the total virtual image field can be translated and rotated.
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DSP Program RTC5OUT.out Version 536 to Version 537

N: select_serial_set, select_serial_set_list, set_serial_step_list, get_list_serial	Up to 4 serial-number-sets available.
C: set_sky_writing_para	Timelag < 1/8 μ s switches sky-writing off, Timelag < 1/4 μ s switches sky-writing on using Timelag = 0.
B: Automatic laser control	At higher speeds the auto laser control value was sometimes calculated wrong.
B: Softstart	Softstart with less than 4 level values didn't work.
N: config_laser_signals_list	Redirection of laser signals to other pins (like config_laser_signals).
B: set_pixel_line, set_pixel_line_3d	As of version 536 ANALOG_OUT2 didn't work and set_pixel_line also used two list spaces. Now set_pixel_line_3d uses only one list space like set_pixel_line, if dZ equals 0, otherwise two list spaces.
N: set_wobbel_direction	Presets a direction of movement to align wobbel shapes.
N: set_wobbel_vector	Defines a section of a „Freely definable wobbel shape“.
N: set_wobbel_control	Configures laser control parameters for „Freely definable wobbel shapes“.
N: set_wobbel_offset	Transversal and longitudinal offset of a wobbel shape.
N: set_multi_mcbasp_in, set_multi_mcbasp_in_list	Activates the receiving of up to 8 different data types from the McBSP interface to be used for a 3D Processing-on-the-fly application with position values as well as for laser control.
N: read_multi_mcbasp	Reads out the type sorted values transferred via McBSP after being activated with set_multi_mcbasp_in.
N: range_checking	Implements an emergency action at a galvanometer position range overflow.
B: Automatic laser control	For mark-jump combinations and a LaserOn delay longer than the mark vector length no laser parameter output has been calculated for the first few cycles, but 0 was put out instead.

DSP-Program RTC5OUT.out Version 537 to Version 538

(intermediate version 538 wasn't an official release)

B: wait_for-loops	With wait_for_encoder, wait_for_encoder_in_range or wait_for_mcbasp just before set_end_of_list the list execution wasn't correctly.finished
N: periodic_toggle, periodic_toggle_list	These commands generate a periodic toggling signal at user defined output pins. For example, it can be used to trigger external peripheral devices synchronous to list execution.
C: mcbasp_init_spi	The McBSP-interface can now be operated in SPI mode as well.
B: list_repeat	The first command following list_repeat was ignored for all passes except the first one.
N: get_z_control	Returns the Z axis output value for the given position/parameters.
N: sub_cal_repeat, sub_cal_abs_repeat	Like sub_call or sub_call_abs, but with arbitrary repetition.

DSP-Program RTC5OUT.out Version 538 to Version 539

N: get_galvo_controls	Returns the output values for all addressed axes for the given position/parameters (replaces the version 538-only command get_z_control).
C: Free variables	Now 8 free variables are available.

DSP-Program RTC5OUT.out Version 539 to Version 540

N: list_call_repeat, list_call_abs_repeat	Like list_call or list_call_abs, but with arbitrary repetition.
B: sky-writing 2/3	Within a sequence jump_* → set_end_of_list → auto_change → arc_* the arc has been marked incorrectly. Within a sequence laser_on[_pulses]_list → jump_* the laser remained switched on during the jump.
N: set_auto_laser_control	Mode = 6 for combined galvanometer and encoder speeds.
B: MOF and start_loop	Any of the set_fly_* commands switched off start_loop.
B: set_wobbel_mode	After switching from classical wobbel figures to the "freely definable wobble figures" the latter possibly could have been executed incorrect.
B: mark_ellipse_abs, mark_ellipse_rel	For positive LaserOnShift values being an integer multiple of 10 µs, an ellipsis command was not terminated in sky-writing mode.

DSP-Program RTC5OUT.out Version 540 to Version 542

(intermediate version 541 wasn't an official release)

B: set_pixel_line	541: set_pixel_line didn't reset the Z-propagation from a previous 3D-command.
B: LASER1 pulselength signal	541: At very short marking vectors with very short LaserOn delays (for example, hatching) the laser pulselength could be overwritten erroneously.
B: set_offset_xyz and goto_xyz	541: After set_offset_xyz with at_once = 2 and goto_xyz get_value(7, 8 or 9) returned false sample values (until the next regular output to the galvanometers).
B: mark_ellipse_abs/rel	541: At certain half axes ratios (especially for small ellipses) the speed along the curve wasn't always correct.
C: Coordinate transformations within the virtual image field	541: Now also available with the commands set_fly_x and/or set_fly_y.
N: list_next	541: Place holder command: executes the next list command immediately.
N: get_lap_time	541: Returns the elapsed time since the last call of save_and_restart_timer (even if a time measurement is in progress).
N: stepper_disable_switch	Ignores the end switch at normal movements.
B: auto_cal	At certain mechanical setups of a scan head with ASC sensors of type 2 auto_cal could have failed.
B: Sky-Writing mode 2	At combinations of jump_abs and mark_abs the Z-movement could be wrong.

DSP-Program RTC5OUT.out Version 542 to Version 543

B: range_checking	Did not work correctly with intelliSCAN data and negative limits.
B: get_z_distance, get_galvo_controls	The immediate next output could be erroneous.
B: Variable Jumpdelay	As of version OUT 540 the RTC5 could get stuck.
C: periodic_toggle, periodic_toggle_list	With Count = $2^{32}-1$ the command toggles endless.
C: set_control_mode, set_control_mode_list	Bit #4 = 1 disables simulate_ext_start_ctrl.
C: set_trigger, set_trigger4	Signal 52: Time stamp counter. Signal 53: Wobbel amplitude. Signal 54: AnalogIn.
N: set_pause_list_cond	Defines the condition at EXTENSION 1 16-bit digital input for an automatic pause_list command.

DSP-Program RTC5OUT.out Version 543 to Version 544

B: list_call_[abs_]cond, sub_call_[abs_]cond	As of version OUT 540 these commands could have been repeated several times.
N: set_port_default_list	Like set_port_default, but a short list command.
N: activate_fly_2d_encoder activate_fly_xy_encoder	Like activate_fly_2d, activate_fly_xy, but with programmable encoder offsets.
B: get_z_distance	Used current Z position instead of the Z parameter.
B: get_galvo_controls	Caused intermediate Z outputs, when the current Z position and the Z parameter did not match.
B: para commands	Caused parameter outputs even if set_vector_control has not been activated.
N: set_pause_list_not_cond	Defines the NOT-condition at EXTENSION 1 16-bit digital input for an automatic pause_list command. C: A conditional pause_list takes precedence over stop_execution.
C: Variable polygon delay, set_sky_writing_limit	The angle is now calculated in 3D.

DSP-Program RTC5OUT.out Version 544 to Version 545

B: Automatic laser control	The combination of galvanometer and encoder speed did not work properly.
N: Global Online-Positioning	Similar to the previous online positioning (without global), but affects the coordinate transformations in the virtual image field.
C: set_angle	Now also available with HeadNo = 4.

DSP-Program RTC5OUT.out Version 545 to Version 546

C: get_startstop_info	The status of the laser control signals can now be read out via bit #14.
B: set_ellipse	Some ellipses could cause the card to stop responding for some time.
B: park_position	With Mode = 0 a wrong starting point was set for the jump.

DSP-Program RTC5OUT.out Version 546 to Version 547

B: list_return	Two consecutive list_return commands without a corresponding list_call caused the card to hang in BUSY state.
B: range_checking	The combination of range_checking mode 0 with pixel mode could cause incorrect pixel lines to be output.

B: Softstart	It could happen that some pulses were skipped.
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DSP-Program RTC5OUT.out Version 547 to Version 548

B: list_on_list	In combination with sky writing mode 2/3, the LaserOn signal sometimes wasn't switched off.
N: clear_fly_overflow_ctrl	Like clear_fly_overflow but a control command.
B: set_multi_mcbasp_in set_multi_mcbasp_in_list	In combination with freely definable wobble shapes, the laser power output could sometimes not work.

DSP-Program RTC5OUT.out Version 548 to Version 549

B: load_list	In some situations the wrong list was loaded for ListNo = 3.
C: set_multi_mcbasp_in set_multi_mcbasp_in_list	New parameter Mode = 2, laser power value is transmitted but never used.

DSP-Program RTC5OUT.out Version 549 to Version 550

N: set_mcbasp_out_ptr_list	Like set_mcbasp_out_ptr but a list command.
C: set_multi_mcbasp_in set_multi_mcbasp_in_list	Parameter Mode = 2 now additionally disables fly correction.
B: stepper_abs_no, stepper_abs	The commands executed relative instead of absolute movements.

DSP-Program RTC5OUT.out Version 550 to Version 551

B: set_fly_2d	The fly correction did not work.
B: load_wobbel_power, load_wobbel_power_list	The power values were calculated incorrectly.

DSP-Program RTC5OUT.out Version 551 to Version 552

B: Coordinate Transformations	For all transformation commands with parameter at_once = 2 the z output value could be calculated incorrectly.
B: wait_for_encoder, wait_for_encoder_mode, wait_for_mcbasp	The output position was calculated incorrectly when using set_fly_rot or set_fly_rot_pos.

DSP-Program RTC5OUT.out Version 552 to Version 553

B: sub_call_cond, list_call_cond	Fix unexpected repetition of subroutines.
C: set_ellipse	Valid range for Phi reduced to [-2880...2880].
B: set_ellipse	Fix endless loop for Phi >= 2880.
B: set_auto_laser_control	Fix correction for Mode 4 with set_fly_x and set_fly_y
B: list_jump_rel, list_jump_rel_cond	Fix relative list jumps in nested subroutines.
B: stop_execution	Fix short list command execution after stop_execution.
B: rs232_read_data	Fix broken read after 2 ¹⁶ transfers.

DLL RTC5DLL.dll Version 511 to Version 512

C: init_rtc5_dll, load_program_file	RTC5_TIMEOUT errors are suppressed during an RTC®5 new start.
B: wait_for_encoder, wait_for_encoder_mode	As of version 511, the commands no longer functioned (due to an interchanged parameter).
B: jump_abs_3d	Didn't vary z.
C: set_auto_laser_ctrl	Mode = 5 enables laser control dependent on the encoder speed.
N: set_encoder_speed, set_encoder_speed_ctrl	Defines the target encoder speed for automatic laser control with mode = 5.
N: switch_ioport	Extension of list_jump..._cond commands. Branches to N (>1) addresses via selectable bits of the 16-bit I/O port.
B: list_jump_rel_cond, list_jump_pos_cond	Jump commands initiating a jump to themselves failed to function, relative jumps were handled as absolute.
N: set_verify, verify_checksum	Verification of all downloads from the PC to the RTC®5, and (separate) checksums of correction files.

DLL RTC5DLL.dll Version 512 to Version 513

B: load_text_table	Didn't function properly (address incorrect).
C: mark_date	Parameter Part = 6, 7: Month and weekday as digits.
C: get_startstop_info	The return value now contains in the upper 16 bits the SL2-100 transferred error bits.
B: load_program_file, load_correction_file	Verify: error return value got set, but not RTC5_VERIFY_ERROR for get_last_error.
C: verify_checksum	Return value = 0 now indicates OK, > 0 error or warning.
N: set_offset_xyz, set_offset_xyz_list	Offsets are now also specifiable for the Z-axis (direction opposite set_defocus).
B: save_disk, load_disk	Didn't function due to an interchanged parameter (abort with get_last_error = RTC5_PARAM_ERROR).
C: load_disk	Parameter Name = 0 now initializes (as with Mode = 0) the internal management tables for list buffer area 3 (for indexed subroutines and characters) without requiring an "empty" file to be loaded.
B: load_z_table	Value range checking in C always failed (return value 16).
C: get_head_status	Reserved bits are now returned as 1.
B: get_table_para	Didn't function properly in all cases, instead only if the table was also assigned to a scan head connector.
C: set_trigger, get_value	Parameters 20-23 return the final output values (incl. gain and offset).

C: get_value	Parameter 0 also returns the current laser status from outside a list execution.
N: In general	During calling of commands, the DLL immediately returns instead of hanging when no board is present on the PCI bus. Eventual return values are undefined. get_last_error then returns RTC5_ACCESS_DENIED.

DLL RTC5DLL.dll Version 513 to Version 514

B: set_laser_control	Laser hardware was enabled too early: For low-active polarities, LASERON could be active for some microseconds.
B: load_disk	Name = 0: address pointer was not reset.
B, C: load_z_table	C: New error bit 64 for "execution denied", B: Previously error 13 (no 3D table assigned) was returned.
B: n_wait_for_encoder	n_wait_for_encoder(...) operated as wait_for_encoder(...)
B: auto_change_pos	A command immediately following get_status could erroneously retrieve "not BUSY" for up to 10µs. This has now been fixed.
C: set_fly_...	Now a fly command with unallowed parameter value only deactivates the fly correction, previously activated via the same command with allowed parameter value (also see change for Hexfile version 512 to version 513).
N: get_mcbasp_list	Queries data from the McBSP buffer (once), in order to make way for the current data transfer (see McBSP interface).
N: get_overrun	Returns the number of overruns of the 10 µs clock period which occurred since the last call of get_overrun (see manual version 1.0).
B: list_call_abs, sub_call_abs	Abs functionality missed. The commands operated as list_call and sub_call.
B: set_port_default, set_laser_off_default	For the analog output ports (ANALOG OUT1 and ANALOG OUT2), deactivation of default value output via "-1" did not correctly work in the RTC®4 compatibility mode. With set_port_default it didn't work even in the RTC®5 mode.
N: set_laser_mode(6)	See change for firmware version 509 to version 511.
B: set_encoder_speed, set_encoder_speed_ctrl	Parameter Smooth missed.
C: set_ext_start_delay, set_ext_start_delay_list, simulate_ext_start	RTC®4 compatibility mode for parameter Delay.
N: home_position_xyz	Enables home jumps also for the Z-axis.

DLL RTC5DLL.dll Version 514 to Version 515

B: n_set_offset, n_set_offset_list	These multi-board commands worked like their single board commands set_offset, set_offset_list.
B: load_correction_file	Under some circumstances, the actual return value could be undefined for get_last_error RTC5_SEND_ERROR.
N: get_standby	Return value: current standby parameters.
N: get_master_slave	Return value: master/slave status of the addressed board.
N: simulate_ext_start_ctrl	Analog to the list command simulate_ext_start, this new control command simulates an external start, but without track delay definition.
N: Fast RTC®5	Identification and settings for faster RTC®5 boards.
N: sync_slaves	Stably synchronizes the slave boards' 10 µs clock phase with the master board's 10 µs clock.
N: laser_on_pulses_list	Laser control: LASERON only for a specified number of external pulses at DIGITAL_IN1, otherwise as laser_on_list.
C: set_laser_control	Bit #5: polarity of external pulses at DIGITAL_IN1.

DLL RTC5DLL.dll Version 515 to Version 516

B: load_z_table	At some situations the C Value was replaced by the B value.
N: get_values	Retrieves up to 4 signal types simultaneously, see get_value (without s) also.
N: upload_transform	Retrieves transformation data.
N: get_transform	Retrieves recorded data and transforms them back.
N: transform	Transforms back single data.
B: rs232_write_data, rs232_write_text	A runtime problem on writing several chars very fast has been resolved.
C: In general: Sending a control command	Improved TIMEOUT handling. The verify option distinguishes between data content errors and PCI transfer errors now.

DLL RTC5DLL.dll Version 516 to Version 517

B: switch_io_port	SwitchNo was calculated without using Mask.
N: set_auto_laser_params, set_auto_laser_params_list	Ctrl, Value, MinValue, MaxValue can be subsequently changed (see set_auto_laser_control).
N: write_io_port_mask, write_io_port_mask_list	Only the masked bits are newly written, the other bits remain unchanged (see write_io_port).
N: timed_para_mark_abs, timed_para_mark_rel, timed_para_jump_abs, timed_para_jump_rel	Simultaneously timed and parameterized 2D commands, also see timed_mark_abs, para_mark_abs, timed_jump_abs, para_jump_abs or ~rel.

N: timed_para_jump_abs_3d, timed_para_jump_rel_3d, timed_para_mark_abs_3d, timed_para_mark_rel_3d	Simultaneously timed and parameterized 3D commands, also see timed_mark_abs_3d, para_mark_abs_3d, timed_jump_abs_3d, para_jump_abs_3d or ~rel_3d.
N: arc_abs_3d, arc_rel_3d	Linear z movement during the angular xy movement.
C: transform, get_transform	Parameter Code changed.
N: stop_trigger	Terminates data storage, when no list is currently active (see measurement_status, set_trigger).

DLL RTC5DLL.dll Version 517 to Version 518

C: sync_slaves	Improved synchronization of master/slave chain.
B: timed_para_mark_rel, timed_para_jump_rel	These 2D commands didn't take dZ into account, but moved Z towards its end position.
C: load_program_file	Doesn't execute an implicit set_start_list(1) anymore. Thus the list status USED for list 1 maintains at startup.
N: set_ellipse	Defines shape and section of an ellipse.
N: mark_ellipse_abs, mark_ellipse_rel	Mark an ellipse around an absolutely or relatively defined center.
N: set_sky_writing_para, set_sky_writing_para_list	Like set_sky_writing, but run-in and run-out freely adjustable.
C: get_rtc_version	New: Bits #16–23 = DSP version info.
C: get_error, get_last_error	New error code: RTC5_TYPE_REJECTED = 1024.

DLL RTC5DLL.dll Version 518 to Version 520

(intermediate version 519 wasn't an official release)

B: set_laser_control	519: Together with set_verify(1) the laser signals didn't become available in all cases.
C: control_command	After Code _H = 0x05, 0x0E and 0x21 a waiting time of 60µs will be automatically inserted. Such waiting time won't be necessary anymore separately prior to get_value.
C: In general: Coordinate transformations	New: at_once = 2. Collecting like at_once = 0, and executing in a shared jump together with goto_xy, goto_xyz, jump_abs or jump_rel.
B: n_laser_on_list	The command operated like laser_on_list (it only effected the default board).
N: store_encoder	Internally stores the current encoder values.
N: read_encoder	Reads out the internally stored encoder values.

C: auto_cal	<p>N: Command = 4: Determines and stores the ASC sensor type.</p> <p>N: Supports the new ASC sensor type 2.</p> <p>C: After the command, the galvanometer scanners will now always be in the same position as before the command (or - if applicable - in the gain/offset-corrected position), but not at their mid-positions.</p>
N: get_auto_cal	Returns the result stored with auto_cal(Command=4).

DLL RTC5DLL.dll Version 520 to Version 521

C: load_correction_file	<p>Calling load_correction_file after load_program_file some boards could produce unexpected position outputs, provided this call wasn't succeeded by select_cor_table until select_cor_table has been explicitly called or load_program_file newly executed.</p> <p>Now load_correction_file will always call select_cor_table automatically using the last applied table numbers.</p>
B: set_sky_writing_para_list	The import declarations erroneously contained the parameter CardNo, whereas the DLL correctly did not.

DLL RTC5DLL.dll Version 521 to Version 523

(intermediate version 522 wasn't an official release)

B: set_pixel_line	522: Since version 518 the parameter dy was faulty.
B: In general: Coordinate transformations	get_status immediately following a corresponding control command could return "not BUSY" within an up to 10 µs gap, before the board could start the command. This has been fixed.
N: set_dsp_mode	This command adjusts the maximum number of short list commands within a 10µs cycle to the allowed number for a smaller CPU frequency (smaller DSP version, see get_rtc_version). Thus different CPU frequencies can be simultaneously used within a common master/slave chain, without any disturbance of an equally timed execution of identical lists.
C: sync_slaves	sync_slaves – via set_dsp_mode – automatically adjusts the maximum number of short list commands within a 10 µs cycle to the slowest CPU frequency within a master/slave chain.

DLL RTC5DLL.dll Version 523 to Version 524

B: load_correction_file	Loading a 3D correction file and downgrading it to Dim = 2 some header parameters have been wrongly set to zero.
N: para_laser_on_pulses_list	Marks a parameterized discrete point.
C: SPI/I ² C interface (McBSP)	No more sticking, if more than two data words are sent to the card and no list with active "processing-on-the-fly" with position data is executing.
N: read_mcbbsp	Reads a memory location of a completed McBSP transfer.
C: get_mcbbsp	Synonymous to read_mcbbsp(0).
N: set_mcbbsp_x/y/rot, set_mcbbsp_x/y/rot_list	Definition of a McBSP transfer's data words interpretation for a coordinate transformation.
N: apply_mcbbsp, apply_mcbbsp_list	Applies the coordinate transformation.
N: time_fix_f_off	Fixes time + offset to be marked.
N: move_to	The control command controls a varioSCAN _{FLEX} Z-axis via the 16-Bit-IO-Port and a StepperMotorExtension board.

DLL RTC5DLL.dll Version 524 to Version 525

C: set_vector_control, parameterized vectors	Parameterized vectors now can be executed with the focus shift (Ctrl = 7) as parameter type
C: Coordinate transformations	With at_once = 3 the laser stays on during the jump (if it is on), in other respects like at_once = 1.
N: list_continue	Separation between short list commands, which in opposite to list_nop keeps the laser on and doesn't execute scanner delays.
N: micro_vector_abs, micro_vector_rel	Executes a single micro step without scanner delays, but with individually programmable laser delays.
N: set_fly_limits	Defines variable limits for Fly-Overflow detection.
N: if_fly_x_overflow, if_fly_y_overflow, if_not_fly_x_overflow, if_not_fly_y_overflow	List command to poll Fly-Overflow detection with the possibility of program branching like, for example, if_cond or if_not_cond.
N: clear_fly_overflow	Deletes detected Fly-Overflows.
C: get_marking_info	Now also returns Fly-Overflow detections with the variable limits.
N: set_jump_tuning, set_jump_tuning_list	Defines tunings for and enables auto-switching between jump mode and vector mode.
N: load_jump_table	Loads an external ASCII jump delay table or automatically determines a new jump delay table.
N: get_jump_table	Reads the jump delay table.

N: set_jump_table	Loads an external, binary jump delay table.
C: auto_cal	Extended algorithm (avoids error 55 for specific ASC-2 systems).

DLL RTC5DLL.dll Version 525 to Version 526

C: set_jump_mode, set_jump_mode_list	The function names have been changed. For compatibility reasons for software, which can't be newly compiled, the previous names set_jump_tuning and set_jump_tuning_list are further available within the DLL, but no more within the current import declarations.
N: load_jump_table_offset	Compared to the previous command load_jump_table an additional parameter Offset has been introduced. For compatibility reasons for software, which can't be newly compiled, this function name has been changed to load_jump_table_offset. The previous name is further available without the new parameter and executes like load_jump_table_offset with Offset = 0.

DLL RTC5DLL.dll Version 526 to Version 527

B: load_program_file	Returns the error code 8 (System driver not found), if no board is plugged into the PC.
N: set_sky_writing_mode, set_sky_writing_mode_list	Switch the Sky-Writing mode.
B: auto_cal	Under some circumstances auto_cal(0) never returned.
N: read_analog_in	PCI-Express board: Returns the voltages AnalogIn0 and AnalogIn1 after they have been digitized by the on-board AD converter. PCI board: Only applicable, if an external plug-on AD converter board (article number 121126) has been attached to the SPI/I2C connector.
C: get_marking_info	Returns the status word error bits, if a surveillance has been set via set_laser_control and an error has occurred.
C: goto_xy, goto_xyz	The commands now wait for the end of the movement.
C: load_correction_file	The command waits for the end of the internal jump to the possibly changed galvanometer positions.
N: Stepper motor signals	The stepper motor signals are available now (see manual as of version 1.5).

DLL RTC5DLL.dll Version 527 to Version 528

(intermediate version 528 wasn't an official release)

B: set_jump_mode	Did not work correctly since version DLL527.
N: set_control_mode, set_control_mode_list	If Bit #1 is set, an external /STOP and stop_execution now also completely delete the waiting queue of not yet expired external starts.
N: set_pulse_picking, set_pulse_picking_list	Laser control with pulse picking mode.

DLL RTC5DLL.dll Version 528 to Version 529

(intermediate version 529 wasn't an official release)

C: set_pulse_picking, set_pulse_picking_list	If No = 0, the LASERON signal is output as LASER2 signal. No > 63 will be clipped to 63.
B: load_sub	If a subroutine has been deleted (via list_return immediately following load_sub), that address became 0 rather than invalid ("-1").
B: stepper_abs/rel	The parameter WaitTime wasn't correctly taken into account, it was rather undefined.
C: set_laser_control	Bit #6 = 1 activates the output synchronization.

DLL RTC5DLL.dll Version 529 to Version 530

C: set_jump_mode	Error codes now distinguish between several causes.
B: para_laser_on_pulses_list	Import declarations only: function name was wrong.
N: set_fly_z	Activates a fly-z application with encoder values.
N: fly_return_z	Like fly_return, in addition it terminates a fly-z application.
N: set_fly_limits_z	Defines variable limits for fly-z-overflow detection.
N: if_fly_z_overflow, if_not_fly_z_overflow,	List command to fly-z-overflow detection (like if_fly_x_overflow, if_not_fly_x_overflow, a.s.o.)
C: clear_fly_overflow	Bits # 5, 6: delete Error bits # 24, 25 from get_marking_info.
C: get_marking_info	Bits # 22 – 25: show fly-z-overflow errors.

DLL RTC5DLL.dll Version 530 to Version 531

N: get_sync_status	Measurement of a SLAVE-board's synchronization status.
N: set_free_variable[_list], get_free_variable[_list]	4 freely usable variables for set_trigger and McBSP-Output.
C: set_trigger	Further data types added for recording via set_trigger.

C: McBSP output	Data formats adapted to data types.
N: set_mcbbsp_out_ptr	Up to 8 data types can be output circularly.
N: set_mcbbsp_in	New input mode for the McBSP interface.
C: read_mcbbsp	Up to 4 internal memory positions can be readout.
B: set_standby[_list]	HalfPeriod = 0 threw a Div#0 exception (since version 530).
B: load_correction_file	Loading a 3D correction table and downgrading it to a 2D table didn't work correctly.
B: read_io_port_buffer	Faulty assignment of the data.
B: Thread safety	Simultaneously using a control command which gives an answer from the board and a control command which doesn't in different threads, the answer could have been wrong.
B: sync_slaves	This control command uses internally other control commands with answers from all the boards found. Therefore it wasn't thread safe (see above).
C: Multi boards	Now control commands with answers can be executed parallel on two different boards. Up to version 530 only one control command could be executed at one board at the same time.
N: set_mcbbsp_freq	The output clock frequency is tunable between 4 and 16 MHz (Default: 8 MHz).
C: set_sky_writing_mode	Mode = 3 available.
N: set_sky_writing_limit, set_sky_writing_limit_list	Definition of a limit value to switch between Sky-Writing modes 2 and 3.
B: set_mark_speed_ctrl	Ellipses didn't mark with the given speed.

DLL RTC5DLL.dll Version 531 to Version 533

(intermediate version 532 wasn't an official release)

B: n_load_program_file with RTC®5-express boards	532: After the PC's warm boot the command could cause the DSP's initialization procedure to hang up. This has been solved. The command now returns Error = 2 (Unreset error). In contrast, previous versions misleadingly returned Error = 7 (Version error). But now under circumstances the analog inputs at the "SPI / I2C" connector could be permanently switched off. The analog inputs would then be available again only after a cold boot of the PC.
B: get_values	532: 64 bit version only: The command caused an access violation exception.
B: get_table_para, get_head_para	532: The parameters 3 and 4 returned false values for negative stretch factors.

B: select_rtc	In a system with multiple RTC [®] 5 boards installed a call to select_rtc with a board number N (N not equal to the current default board number) could acquire the board number N in spite of a version mismatch. Not correcting the version mismatch, a subsequent call to multi board commands for board number N could have unpredictable results. Any access to that board from a different thread (other than the thread calling select_rtc) could suspend the thread infinitely (since RTC5DLL.dll version 531), in spite of having corrected the version mismatch before.
N: set_pulse_picking_length	Defines a constant pulse length for the pulse picking signal, independently from the current "Laser active" pulse length.
C: set_laser_control	Provided, the pulse picking mode is switched on, Bit #7 = 1 activates the constant pulse length mode.
N: config_laser_signals	The laser control signals LASERON, LASER1, LASER2 and the FirstPulseKiller signal can be freely redirected to the laser connector pins no. 1, 2 and 9.
C: load_correction_file, select_cor_table, select_cor_table_list	Up to 4 correction tables can be loaded on the RTC5 board at the same time.

DLL RTC5DLL.dll Version 533 to Version 535

(intermediate version 534 wasn't an official release)

C: Driver	534: Modification for the new driver 6.1.7600.16385, downward compatible to the previous driver 2.0.6.0.
C: Error messages	534: New error messages: RTC5_OUT_OF_MEMORY, RTC5_EEPROM_ERROR, RTC5_CONFIG_ERROR.
C: Energy Saving Mode	534: As soon as init_rtc5_dll has been called, the PC doesn't switch into an automatic energy saving mode anymore, not even though, if the DLL is unloaded again.
N: set_fly_tracking_error	POF: Defines an encoder value dependent tracking error compensation.
N: set_mcbasp_matrix, set_mcbasp_matrix_list	Online Positioning: Specification of interpretation of the McBSP transferred data words as a matrix coefficient for the coordinate transformation.
C: get_hex_version, get_rtc_version	Now always return the loaded version numbers, even after a version mismatch error.

DLL RTC5DLL.dll Version 535 to Version 536

N: micro_vector_abs_3d	Like micro_vector_abs, but with a 3D micro vector end point.
N: micro_vector_rel_3d	Like micro_vector_rel, but with a 3D micro vector end point.

N: set_softstart_level_list	Similar as set_soft_start_level, but a list command.
N: set_softstart_mode_list	Like set_soft_start_mode, but a list command.
N: set_delay_mode_list	Like set_delay_mode, but a list command.
N: load_fly_2d_table	Downloads an XY stage encoder compensation table (for set_fly_2d sessions only).
N: set_fly_2d	Activates a 2D fly session (for XY stages).
N: init_fly_2d	Initializes the start position of an XY stage for an encoder compensation table.
N: get_fly_2d_offset	Returns the current offset values for the encoder compensation table.
N: wait_for_encoder_in_range	Waits until both encoders fall within the given range (2D fly or XY fly sessions only).
N: set_trigger4	Allows to simultaneously record 4 channels with half of the storage space for each channel.
C: set_trigger, get_value	Signals 43 and 44 (Encoder0 and Encoder1) can be recorded and read out.
C: set_encoder_speed	Sets the 100% value for the vector speed from both encoder channels for the encoder-speed-dependent automatic laser control.
C: Automatic laser control	New option: vector encoder speed for 2D fly or XY fly sessions.
C: set_laser_control	Bit #28 = 1: In the case of an error, the laser-signal auto-suppression will automatically create a /STOP signal (the list stops, the laser switches off permanently).
N: load_stretch_table	Extended 3D correction (z-dependent field rectification).
N: activate_fly_2d, activate_fly_xy	Activates the fly corrections like set_fly_2d resp. set_fly_x and set_fly_y, but without an encoder reset.
N: if_not_activated	In the case of an error with activate_fly_2d or activate_fly_xy, allows a list jump, for example.
N: park_position, park_return	Jumps to a secure parking position and returns within fly correction sessions (2D fly and XY fly only).
N: repeat_list, until_list	Structured programming: Allows a numbered repetition of a group of list commands.
N: set_pixel_line_3d	Pixel mode along a 3D vector.
N: Coordinate transformations within the virtual image field	In set_fly_2d sessions only: the total virtual image field can be translated and rotated.

DLL RTC5DLL.dll Version 536 to Version 537

N: select_serial_set, select_serial_set_list, set_serial_step_list, get_list_serial	Up to 4 serial-number-sets available.
C: set_sky_writing_para	Timelag < 1/8 μ s switches sky-writing off, Timelag < 1/4 μ s switches sky-writing on using Timelag = 0.
B: load_program_file	“PCI-Error” and “RTC5OUT has wrong format” both returned the error code 4. Now “PCI-Error” returns 16.
B: set_pixel_line, set_pixel_line_3d	As of version 536 ANALOG_OUT2 didn't work and set_pixel_line used also two list spaces. Now set_pixel_line_3d uses only one list space like set_pixel_line, if dZ equals 0, otherwise two list spaces.
N: config_laser_signals_list	Redirection of laser signals to other pins (like config_laser_signals).
N: set_wobbel_direction	Presets a direction of movement to align wobbel shapes.
N: set_wobbel_vector	Defines a section of a „Freely definable wobbel shape“.
N: set_wobbel_control	Configures laser control parameters for „Freely definable wobbel shapes“.
N: set_wobbel_offset	Transversal and longitudinal offset of a wobbel shape.
N: set_multi_mcbasp_in, set_multi_mcbasp_in_list	Activates the receiving of up to 8 different data types from the McBSP interface to be used for a 3D Processing-on-the-fly application with position values as well as for laser control.
N: read_multi_mcbasp	Reads out the type sorted values transferred via McBSP after being activated with set_multi_mcbasp_in.
N: range_checking	Implements an emergency action at a galvanometer position range overflow.
C: C# import declarations	Supports the option „Any CPU“.

DLL RTC5DLL.dll Version 537 to Version 538

(intermediate version 538 wasn't an official release)

B: get_serial_list	Import declarations only: Variable name "Set" is not allowed in Delphi.
import declarations for implicate linking	RTC5impl.h and RTC5impl.hpp now use __cdeclspec instead of _cdeclspec.
N: periodic_toggle, periodic_toggle_list	These commands generate a periodic toggling signal at user defined output pins. For example, it can be used to trigger external peripheral devices synchronous to list execution.
C: mcbasp_init_spi	The McBSP-connection can now be operated in the SPI mode as well.
N: get_z_control	Returns the Z axis output value for the given position/parameters.
N: sub_cal_repeat, sub_cal_abs_repeat	Like sub_cal or sub_cal_abs, but with arbitrary repetition.

DLL RTC5DLL.dll Version 538 to Version 539

B: arc_rel_3d	arc_rel_3d behaved like arc_abs_3d
N: get_galvo_controls	Returns the output values for all addressed axes for the given position/parameters (replaces the version 538-only command get_z_control).
C: Free variables	Now 8 free variables are available.
B: Windows XP	DLL version 5.39.0.1 now runs on Windows XP, too.

DLL RTC5DLL.dll Version 539 to Version 540

B: set_laser_off_default	The parameter DigitalOut has been ignored as of version 537.
B: sync_slaves	Possibly sometimes cards didn't synchronize.
N: list_cal_repeat, list_cal_abs_repeat	Like list_cal or list_cal_abs, but with arbitrary repetition.
N: set_auto_laser_control	Mode = 6 for combined galvanometer and encoder speeds.
C: Import declarations for C/C++	ULONG_PTR is now defined as a function of _WIN64. WIN32 is already used by WINDOWS elsewhere.

DLL RTC5DLL.dll Version 540 to Version 542

(intermediate version 541 wasn't an official release)

B: get_galvo_controls	541: Returned the values in the array OutPtr shifted by one position.
B: set_pixel_line	541: set_pixel_line didn't reset the Z-propagation from a previous 3D-command.
B: set_offset_xyz and goto_xyz	541: After set_offset_xyz with at_once = 2 and goto_xyz get_value(7, 8 or 9) returned false sample values (until the next regular output to the galvanometers).
C: Coordinate transformations within the virtual image field	541: Now also available with the commands set_fly_x and/or set_fly_y.
N: list_next	541: Place holder command: executes the next list command immediately.
N: get_lap_time	541: Returns the elapsed time since the last call of save_and_restart_timer (even if a time measurement is in progress).
N: stepper_disable_switch	Ignores the end switch at normal movements.
B: Windows service	The RTC5 can now also be used with a Windows service (as of Win 7 and DLL 536 always an RTC5_ACCESS_DENIED error was generated). DLL 5.42.0.1: Bugfix Multiprocessing.
B: auto_cal	At certain mechanical setups of a scan head with ASC sensors of type 2 auto_cal could have failed.

DLL RTC5DLL.dll Version 542 to Version 543

B: camming	With C# and/or 64-bit DLL an exception could have been thrown, if parameter Code = 0 was set.
B: range_checking	Mode = 1 could only be selected with Mode > 1.
N: set_pause_list_cond	Defines the condition at EXTENSION 1 16-bit digital input for an automatic pause_list command.
C: periodic_toggle, periodic_toggle_list	With Count = $2^{32}-1$ the command toggles endless.
B: save_disk, load_disk	The binary file could be kept open as long as the application was active.
B: load_char, load_sub	After the protected memory area ("List3") was set to 0, these commands were rejected, even if it was reset to a finite value back again.
C: Import declarations	RTC5impl.h, RTC5expl.h, RTC5expl.c, RTC5impl.hpp are prepared for non-Windows operating systems.

C: set_trigger, set_trigger4	Signal 52: Time stamp counter. Signal 53: Wobbel amplitude. Signal 54: AnalogIn
C: set_control_mode, set_control_mode_list	Bit #4 = 1 disables simulate_ext_start_ctrl.

DLL RTC5DLL.dll Version 543 to Version 544

B: load_fly_2d_table, load_stretch_table	The functionality could have been activated in spite of an erroneous command (for example, file not found).
N: set_port_default_list	Like set_port_default, but a short list command.
N: activate_fly_2d_encoder activate_fly_xy_encoder	Like activate_fly_2d, activate_fly_xy, but with programmable encoder offsets.
B: get_z_distance	Used current Z position instead of the Z parameter.
N: set_pause_list_not_cond	Defines the NOT-condition at EXTENSION 1 16-bit digital input for an automatic pause_list command. C: A conditional pause_list takes precedence over stop_execution.
C: load_progam_file	Changed/new error code values: 14: external memory error (up to now: in general) 16: internal memory error (up to now: 14) 17: PCI error (up to now: 16).
C: simulate_extern_start	Waits internally for 30 µs for save execution.
B: set_vector_control	Limits for parameters 1 and 2 have been scaled wrong.
B: load_zoom_correction_file	Memory leak removed.
C: In general: load-table commands	get_last_error returns also an RTC5_PARAM_ERROR with some error return values (for example, file not found).
B: DLL export definitions	RTC5DLL.dll: set_port_default_list, [n_]set_pause_list_not_cond were missed. New Windows version 5.44.0.9.

DLL RTC5DLL.dll Version 544 to Version 545

B: load_jump_table_offset	The automatic determination did not work.
N: Global Online- Positioning	New commands: set_mcbbsp_global_x, set_mcbbsp_global_y, set_mcbbsp_global_rot, set_mcbbsp_global_matrix, set_mcbbsp_global_x_list, set_mcbbsp_global_y_list, set_mcbbsp_global_rot_list, set_mcbbsp_global_matrix_list. Similar to the previous online positioning (without global), but affects the coordinate transformations in the virtual image field.
C: set_angle	Now also available with HeadNo = 4.

DLL RTC5DLL.dll Version 545 to Version 546

B: load_program_file	When accessed simultaneously from several applications, the programs could block each other.
C: get_startstop_info	The status of the laser control signals can now be read out via bit #14.
B: write_abc_to_file	The checksum in the correction file was not updated.
B: set_multi_mcbasp_in	It could happen that not all parameters were sent to the card.
C: load_sub load_char load_text_table	The input pointer now becomes invalid and the error RTC5_REJECTED is set when the end of list memory 3 in a subroutine is reached.
B: periodic_toggle periodic_toggle_list	The output values for ANALOG_OUT1 and ANALOG_OUT2 were too small by a factor of 16.

DLL RTC5DLL.dll Version 546 to Version 547

B: micro_vector_rel_3d	The command was executed with absolute instead of relative coordinates.
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DLL RTC5DLL.dll Version 547 to Version 548

N: clear_fly_overflow_ctrl	Like clear_fly_overflow but a control command.
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DLL RTC5DLL.dll Version 548 to Version 549

C: set_multi_mcbasp_in set_multi_mcbasp_in_list	New parameter Mode = 2, laser power value is transmitted but never used.
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DLL RTC5DLL.dll Version 549 to Version 550

N: set_mcbasp_out_ptr_list	Like set_mcbasp_out_ptr but a list command.
C: set_multi_mcbasp_in set_multi_mcbasp_in_list	Parameter Mode = 2 now additionally disables fly correction.
B: set_mcbasp_out_ptr	Could throw an exception when passing a NULL pointer.
B: set_trigger	Signal 53 and 54 were not recorded correctly.

DLL RTC5DLL.dll Version 550 to Version 551

C: set_ellipse	Valid range for Phi reduced to [-2880...2880].
B: set_ellipse	Fix endless loop for Phi >= 2880.