RT3D-27 Validation Test Summary Report

Introduction

The purpose of the validation testing is to confirm complete backwards compatibility between the existing CM1 RevC and the new CM1 RevD/E.

The RevD and RevE hardware are considered identical within the scope of the testing. The RevE is the same hardware as the RevD except CN4 is not populated. CN4 is an additional internal connector not used by the standard motor. This connector is not present on RevC.

Applicable part numbers are

Old Part Number	New Part Number
CM1-C-23L20C CM1-P-23L20C	CM1-C-23L20D/E CM1-P-23L20D/E
CM1-C-23S30C CM1-P-23S30C	CM1-C-23S30D/E CM1-P-23S30D/E
CM1-C-17L30C CM1-P-17L30C	CM1-C-17L30D/E CM1-P-17L30D/E
CM1-C-17S30C CM1-P-17S30C	CM1-C-17S30D/E CM1-P-17S30D/E
CM1-C-11L20C CM1-P-11L20C	CM1-C-11L20D/E CM1-P-11L20D/E
CM1-C-11S30C CM1-P-11S30C	CM1-C-11S30D/E CM1-P-11S30D/E

The micro-controller on the CM1 Cool Muscle line of motors has been updated. The original micro-controller UPD70F3025A (V853) has been replaced with the UPD70F3454 (V850/IG3) which was deemed end of life by Renesas Electronics. The firmware has been updated for the new UPD70F3454 (V850/IG3) micro-controller. The changes were subject to full backwards compatibility validation testing as per Myostat's ISO 9001:2015 engineering quality standards.

The following tests were conducted

1. Physical dimensions
2. Communication with all existing interfaces
3. Multiple motor daisy chaining
4. Digital inputs
5. Analog input
6. Digital outputs
7. CML motor functions (parameters, logic and program banks, homing modes, input/output functions, etc)
8. Torque/Speed curves
9. Speed ripple and position accuracy
10. Operating temperature

A further breakdown of these tests can be seen in the Test Summary.

Test Summary

The following table lists a summary of all test cases and their results.

Test Group	Test Case #	Test Summary	Test Result
Molex 12 pin connector pinouts	RTO3-127	Ensure 12-pin Molex connector pinout matches existing RevC hardware	Pass
Verify Communications with existing cables	RTOS-128	Test connectivity with communication cabled CM1US1 and CM1C3	Pass
	RTOS-129	Test communication at available baud rates (9600, 19200, 38400, 57600)	Pass
Daisy Chaining Multiple motors - Up to 15 motors	RTOS-130	Test daisy chain communication 1. All RevD, 2. Mixed RevD and RevC	Pass
Functionality with CM1 interface modules	RTOS-130	SRL - serial master and slave modules	Pass
	RTOS-131	EIO - Test IO, comms and daisychain with EIO module	Pass
	RTOS-132	IPX - Test communication with IPX module	Pass
	RTOS-133	EIP - Test communication over Ethernet/IP, test USB communication	Pass
	RTOS-134	MBT - Test communication with Modbus TCP master, test USB communication	Pass

Test Group	Test Case #	Test Summary	Test Result
Inputs • Digital Functions • Analog Functions • Input electrical specifications		Test digital input function:	
	RTOS-135	No action	Pass
	RTOS-136	General use	Pass
	RTOS-137	Origin sensor	Pass
	RTOS-138	Manual feed	Cond. Pass
	RTOS-139	CW limit switch and origin sensor	Pass
	RTOS-140	E-stop	Pass
	RTOS-142	Full stop	Pass
	RTOS-143	CCW limit switch and origin sensor	Pass
	RTOS-144	Alarm reset/pause	Pass
	RTOS-145	Motor free	Pass
	RTOS-146	Reset counter	Pass
	RTOS-147	Execute next program bank step	Pass
	RTOS-148	Execute previous program bank step	Pass
	RTOS-149	Execute bank 1	Pass
	RTOS-150	Go origin	Pass
	RTOS-151	Jog motor	Pass
	RTOS-152	Execute bank 2	Pass
	RTOS-153	Execute bank 3	Pass
	RTOS-154	Enable motor	Pass
	RTOS-155	Quick response	Pass
	RTOS-156	Slow response time	Pass
		Test analog input functions:	
	RTOS-160	Position control	Pass
	RTOS-161	Speed control	Pass
	RTOS-162	Controlling p-registers	Pass
	RTOS-163	Controlling s-registers	Pass
	RTOS-164	Controlling proportional speed	Pass
	RTOS-165	Controlling position multiplier	Pass
Outputs		Test digital output functions:	
	RTOS-166	No action	Pass
	RTOS-167	In position	Pass
	RTOS-168	Alarm	Pass
	RTOS-169	O1/F1	Pass
	RTOS-170	O2/F2	Pass
	RTOS-171	Merge motion	Pass
	RTOS-172	Quadrature output	Pass
	RTOS-173	Motor free	Pass
	RTOS-174	Torque limit reached	Pass

Test Group	Test Case #	Test Summary	Test Result
		Test analog output functions:	
	RTOS-175	Target position	Pass
	RTOS-176	Target position x 8	Pass
	RTOS-177	Current position	Pass
	RTOS-178	Current position x 8	Pass
	RTOS-179	Position error	Pass
	RTOS-180	Position error x 8	Pass
	RTOS-181	Current velocity ÷ 16	Pass
	RTOS-182	Current velocity ÷ 2	Pass
	RTOS-183	Torque current	Pass
	RTOS-184	Torque current x 8	Pass
Status Alarms		Test status/alarm conditions:	
	RTOS-185	Status 0: motor running	Pass
	RTOS-186	Status 1: Position error overflow	Pass
	RTOS-187	Status 2: Over speed	Pass
	RTOS-188	Status 4: Over load	Pass
	RTOS-189	Status 8: In position	Pass
	RTOS-190	Status 16: Motor disabled	Pass
	RTOS-191	Status 32: Pushmode torque limit reached	Pass
	RTOS-192	Status 128: Over temperature	Pass
	RTOS-193	Status 256: Pushmode timeout not reached	Pass
	RTOS-194	Status 512: E-stop active	Pass
Pulse Type	RT3D-9	Test Step-Direction operation	Pass
	RT3D-13	Test CW-CCW operation	Pass
Origin Search	RTOS-196	Home to Hard Stop	Pass
	RTOS-197	Home to Limit Switch	Pass
Modbus	RTOS-198	Verify baud rates, holding registers and general modbus operation	Pass
RS-485 Mode	RTOS-199	Test RS-485 mode can be enabled and disabled and behaves as defined	Pass
K-Parameters		Test K-parameter functionality	
	RTOS-200	K1 - Home Offset Resolution	Pass
	RTOS-201	K2 - Production date	Pass
	RTOS-202	K3 - Max Speed	Pass
	RTOS-203	K4 - Max Current	Pass
	RTOS-204	K5 - Current P Gain	Pass

Test Group	Test Case #	Test Summary	Test Result
	RTOS-205	K6 - Current I Gain	Pass
	RTOS-206	K7 - Drive PWM Frequency	Pass
	RTOS-207	K8 - Velocity Compensation	Pass
	RTOS-208	K9 - Voltage Target Limit	Pass
	RTOS-209	K10 - Speed Compensation	Pass
	RTOS-210	K11 - Control Mode	Pass
	RTOS-211	K12 - Non-drive Current Target	Pass
	RTOS-212	K13 - Product ID	Pass
	RTOS-213	K14 - Power Up Delay	Pass
	RTOS-214	K15 - Agent Password	Pass
	RTOS-215	K0 - Internal parameter	Pass
	RTOS-216	K16 - Motor Type	Pass
	RTOS-217	K17 - Overload Alarm Level	Pass
	RTOS-219	K18 - Overload Alarm Frequency	Pass
	RTOS-220	K19 - Serial Number	Pass
	RTOS-223	K20 - Baud Rate	Pass
	RTOS-224	K21 - Semi/Full Closed Loop	Pass
	RTOS-225	K22 - Time delay for semi closed loop	Pass
	RTOS-226	K23 - Event status	Pass
	RTOS-227	K24 - Quadrature Output Interval	Pass
	RTOS-228	K25 - Time Delay for Slow signal response	Cond. Pass
	RTOS-229	K26 - Invert Input	Pass
	RTOS-230	K27 - Input Function logical high	Pass
	RTOS-231	K28 - Input Function Quick Response	Pass
	RTOS-232	K29 - Input Function falling edge quick response	Pass
	RTOS-233	K30 - Input Function Slow Response High	Pass
	RTOS-234	K31- Input Function rising edge slow response	Pass
	RTOS-235	K32 - Input Function falling edge slow response	Pass
	RTOS-236	K33 - Output Logic	Pass
	RTOS-237	K34 - Output Function	Pass
	RTOS-238	K35 - Analog Output Function	Pass
	RTOS-239	K36 - Pulse Interface - bank 2/3 execution	Pass
	RTOS-240	K37 - Resolution and Speed Unit	Pass
	RTOS-241	K38 - Analog Interface	Pass
	RTOS-242	K39 - Voltage Filter Gain	Pass
	RTOS-243	K40 - Max Speed for Analog Control	Pass
	RTOS-244	K41 - Travel Range for Analog Position Control	Pass
	RTOS-245	K42 - Go Origin Speed	Pass
	RTOS-246	K43 - Go Origin/Manual Feed Accleration	Pass
	RTOS-247	K44 - Deceleration Ratio	Pass
	RTOS-248	K45 - Origin Direction	Pass
	RTOS-249	K46 - Origin Search Method	Pass
	RTOS-250	K47 - Origin Stopper Voltage Level	Pass
	RTOS-251	K48 - Home Offset Distance	Pass
	RTOS-252	K49 - Manual Feed Speed	Pass
	RTOS-253	K50 - Manual Jog Distance	Pass
	RTOS-254	K51 - Creeping Speed	Pass
	RTOS-255	K52 - Digital / Serial IO	Pass
	RTOS-256	K53 - Brake Output	Pass

Test Group	Test Case #	Test Summary	Test Result
	RTOS-257	K54 - Quadrature Output Offset	Pass
	RTOS-258	K55 - Inposition Tolerance	Pass
	RTOS-259	K56 - Position Error Overflow Alarm Level	Pass
	RTOS-260	K57 - Overload Alarm Time Delay	Pass
	RTOS-261	K58 - Software Limit (+)	Pass
	RTOS-262	K59 - Software Limit (-)	Pass
	RTOS-263	K60 - Pushmode Current Level	Pass
	RTOS-264	K61 - Push Time	Pass
	RTOS-265	K62 - RS-485 Node ID	Pass
	RTOS-266	K63 - External Encoder Input	Pass
	RTOS-269	K64 - Analog Input Function	Pass
	RTOS-270	K65 - Slave motor baudrate	Pass
	RTOS-271	K66 - Data Streaming	Pass
	RTOS-272	K67 - Data Streaming period	Pass
	RTOS-273	K68 - S Curve Function	N/A
	RTOS-274	K69 - S Curve Gain	Pass
	RTOS-275	K70 - Send Carriage Return	Pass
	RTOS-276	K71 - Temperature Limit	Pass
	RTOS-277	K72 - Regen Voltage Limit	Pass
	RTOS-278	K73 - Merge Motion Output Signal Length	Pass
	RTOS-279	K74 - External Torque Feedback P-Gain	Pass
	RTOS-280	K75 - External Torque Feedback I-Gain	Pass
	RTOS-281	K76 - Calibration Wait Timer	Pass
	RTOS-282	K77 - External Torque Feedback Mean Value	Pass
	RTOS-283	K78 - External Torque Feedback Gain	Pass
	RTOS-284	K83 - Digital Input Filter	Pass
	RTOS-285	K85 - Logic Bank Run on Powerup	Pass
	RTOS-286	K86 - Coordinated Motion Sync	Pass
	RTOS-302	K87 - Logic Bank Scan Times	Pass
	RTOS-288	K88 - External Encoder Resolution	Pass
	RTOS-289	K89 - Modbus Input Register Address	Pass
	RTOS-290	K90 - Modbus Output Register Address	Pass
Direct Mode	RTOS-291	Test Direct commands. P0, A0, S0, M0, ^ and]	Pass
Registers		Test all registers (R,N,V,P,A,S,M,T) for:	
	RTOS-298	Number of registers in each register set	Pass
	RTOS-299	Min and max values	Pass
Logic and Program Banks		Test maximum values	
	RTOS-300	Number of banks	Pass
	RTOS-301	Number of steps	Pass

Test Group	Test Case #	Test Summary	Test Result
		Verify all bank commands	
	RTOS-292	'~' - Continuous point motion command	Pass
	RTOS-293	'|' - Homing/Origin commands	Pass
	RTOS-294	'(' , ')' - Enable and disable commands	Pass
	RTOS-295	'#' - Save position command	Cond. Pass
	RTOS-296	'[' , ']' , '}' , '>' , '<', '$' - Bank execution commands	Pass
	RTOS-304	'@' - coordinated motion commands	Pass
	RT3D-33	Verify all logic commands '&&' , '||', '+' , '-' , '*' , '\' , '=" , '==', '!=' ,'>', '>=', '<', '<='	Pass
	RT3D-39	Verify all internal variables "Px", "Sx", "Ix", "Ux", "Pt", "AIN4", "St", "Fx", "Cx", "Cx2", "Cx3", "Cx4", integer, 4 char string	Pass
	RTOS-302	Logic Bank scan times	Pass
Queries	RTOS-297	Test all manual queries ? - direct query ?1 - specific bank query ?1000 - all bank query ?51 - Output 1 ?52 - Output 2 ?70 - Combined inputs ?71 - Temperature ?74 - Analog input ?76 - High speed counter ?79 - Push mode ?85 - Motor ID and firmware version ?90 - K20-K90 ?91 - P registers values ?92 - S registers values ?93 - A registers values ?94 - T registers values ?95 - Position error ?96 - Position ?97 - Speed ?98 - Current ?99 - Status	Pass
Motion	RT3D-30	Validate the torque-speed curve of the CM1 RevD	Pass

Test Group	Test Case #	Test Summary	Test Result
	RT3D-31	Validate the speed accuracy of the CM1 RevD	Pass
	RT3D-32	Validate the position accuracy of the CM1 RevD	Pass
H Parameters	RTOS-303	Validate H parameters can be modified and saved.	Pass
Operating Temperature	RTOS-305	Validate operating temperature	Pass

Test Results

All aspects of the CM1 RevD were tested for backwards compatibility against the CM1 RevC. The tests included testing user functions and motor performance such as speed ripple, torque at speed and position accuracy.

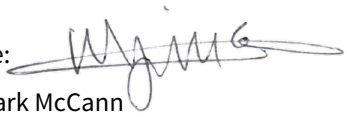
Certain functions as seen in the tests summary were given conditional passes or N/A for the following reasons:

Test Case #	Test Description	Test Result	Reason
RTOS-138	Using an input for a manual feed	Conditional Pass	If multiple inputs are programmed as a manual feed input the highest number input will function at some undetermined slow speed. The lower inputs will not feed execute a feed. RevC and RevD exhibit the same behaviour. As this test is testing of backwards compatibility it is issued a pass. The issue is submitted as firmware bug RT3D-28
RTOS-228	K25 - Slow response time	Conditional Pass	K25 timing is not as indicated in documentation. RevC and RevD exhibit the same behavior and as such is given a conditional pass due to conformity to backwards compatibility. The issue is submitted as a firmware bug RT3D-36
RTOS-273	S-curve function	N/A	The s-curve function option was not implemented in RT3 firmware. It is no longer a valid function and shall be removed from documentation. It has been added as firmware bug RT3D-34
RTOS-295	Using the # command in a bank to save the current motor position to a position register	Conditional Pass	The # command does not function in RevC and RevD. As this is a test for backwards compatibility it is issued a conditional pass. The issue is submitted as firmware bug RT3D-30.

A conditional pass indicates that the test passes on the condition of backwards compatibility only and not documented functionality.

Test Summary Report Approvals

The undersigned acknowledge they have reviewed the *RT3D-27 Validation Test Summary Report*. Changes to this report shall be in accordance with Myostat Motion Control Ltd's Quality Management System.

Signature:  Date: 03/05/2019

Name: Mark McCann

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