

**EC TYPE EXAMINATION (MODULE B) CERTIFICATE
(EC-US MRA)**No. **03-001987/031608 rev.1****THIS IS TO CERTIFY:**

That Croatian Register of Shipping did undertake the relevant type approval procedures for the equipment identified below which was found to be in compliance with requirements of Marine Equipment Directive (MED) 2014/90/EU, subject to any conditions in the schedule attached hereto.

TYPE AND DESCRIPTION OF PRODUCT**SIMRAD R5000 Radar System****NUMBER AND ITEM DESIGNATION** (in accordance with Annex of Regulation (EU) 2023/1667)

MED/4.64 – Radar equipment CAT 1, CAT 2, CAT 3, CAT 1H, CAT 2H

MANUFACTURER:**NAVICO RBU ITALIA S.r.l.****Via Romita 26, 50025 Montagnana VP, Firenze – ITALY**

Place of production (if different from above or where there are several): -

REGULATIONS AND STANDARDS (in accordance with Annex of Regulation (EU) 2023/1667)

SOLAS 74 Reg. V/18, SOLAS 74 Reg. V/19, SOLAS 74 Reg. X/3, IMO Res.A.278(VIII), IMO Res.A.694(17), IMO Res.MSC.191(79), IMO Res.MSC.192(79), IMO Res.MSC302(87), IMO MSC.1/Circ.1349, ITU-R M.1177-4(04/11), IMO Res. MSC.36(63)-(1994 HSC Code) 13 and IMO Res. MSC.97(73)-(2000 HSC Code)13.

USCG Module B number: 165.115/EC2489/03-001987, 165.116/EC2489/03-001987, 165.117/EC2489/03-001987, 165.216/EC2489/03-001987, 165.217/EC2489/03-001987, (see application/limitation of use)**NOTICE:**

1. Further details of the product and conditions for certification are given overleaf.
2. This certificate will not be valid if the manufacturer makes any changes or modifications to the approved equipment, which have not been notified to, and agreed with the notified body named on this certificate.
3. Should the specified regulations or standards be amended during the validity of this certificate, the product(s) is/are to be re-approved prior to it/they being placed on board vessels to which the amended regulations or standards apply.
4. The Mark of Conformity may only be affixed to the above type approved equipment and a Manufacturer's Declaration of Conformity issued when the production-control phase module (D, E, or F) of Annex II of the Directive is fully complied with and controlled by a written inspection agreement with a notified body.
5. In case limitations of use apply, these should be indicated of in the Schedule of Approval.
6. This product has been assigned **U.S. Coast Guard Module B number** in accordance with the European Council Decision 2004/425/EC dated 21 April 2004 on the conclusion of an Agreement between the European Community and the United States of America on Mutual Recognition of Certificates of Conformity for Marine Equipment, as amended by Decision No.1/2018 of the Joint Committee established by the Agreement of the European Community and the United States of America of 18 February 2019.



Issued by Croatian Register of Shipping, notified body number 2489.

This certificate is valid until: **2027-11-14**Place and date: **Split, 2023-12-20**

Seal

Signature

Marinko Popović, dipl.ing.

THE SCHEDULE OF APPROVAL

1. PRODUCT DESCRIPTION

SIMRAD R5000 Radar System consists of the different components:

This is stated in the Annex 1 to this EC type examination (Module B) certificate – 03-001987/031608 rev.1.

System may be configured in accordance with correlation table:

This is stated in the Annex 2 to this EC type examination (Module B) certificate – 03-001987/031608 rev.1.

2. APPLICATION/LIMITATION OF USE

SIMRAD R5000 Radar System is found to comply with the Radar carriage requirements for different kind of vessels in all three categories CAT 3, CAT 2, CAT 1 as well as for HSC vessels:

	CAT 3	CAT 2	CAT 1
<i>Minimum operational display area diameter</i>	<i>180 mm</i>	<i>250 mm</i>	<i>320 mm</i>
<i>Auto acquisition of targets</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Minimum acquired radar target capacity (actual)</i>	<i>20 (100)</i>	<i>30 (100)</i>	<i>40 (100)</i>
<i>Minimum activated AIS target capacity (actual)</i>	<i>20 (100)</i>	<i>30 (100)</i>	<i>40 (100)</i>
<i>Minimum sleeping AIS target capacity (actual)</i>	<i>100 (300)</i>	<i>150 (300)</i>	<i>200 (300)</i>
<i>Minimum total AIS target and reports capacity (actual)</i>	<i>120 (300)</i>	<i>180 (300)</i>	<i>240 (300)</i>
<i>Trial manoeuvre</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>

This product has been assigned U.S. Coast Guard Approval Category for the Radar Equipment with Automatic Radar Plotting Aid (ARPA), Radar Equipment with Automatic Tracking Aid (ATA) as well as Radar Equipment with Electronic Plotting Aid (EPA).

However the manufacturer must obtain the Federal Communication Commission (FCC) certification on the Radar System before installation on board the U.S. vessel.

The R5000 radar system is tested for compliance with BAM requirements – IMO Res.MSC.302(87).

Communication with ship's VDR is provided by DVI video display and IEC 61162-450 network interface.

3. DESIGN DRAWINGS AND SPECIFICATIONS

*GENERAL DESCRIPTION OF THE SYSTEM - Simrad R5000 Radar Line,
R5000 S-BAND DOWN-MAST RADAR SYSTEM (Block Diagram) - 992-24490-00,
R5000 S-BAND UP-MAST RADAR SYSTEM (Block Diagram) - 992-24491-00,
R5000 X-BAND DOWN-MAST RADAR SYSTEM (Block Diagram) - 992-24492-00,
R5000 X-BAND UP-MAST RADAR SYSTEM (Block Diagram) - 992-24493-00,
R5000 HALO 5000 BAND UPMAST VDC RADAR SYSTEM (Block Diagram) - 992-33162-00,
5000 HALO 5000 BAND UPMAST VAC RADAR SYSTEM (Block Diagram) – 992-33163-00.*

TECHNICAL MANUALS:

*R5000 - Commissioning manual - 988-12293-005,
R5000 - Operator Manual - 988-12294-005,
R5000 - Quick reference guide - 988-12280-001,
R5000 - Quick guide multilingual - 988-12281-001,
R5000 - PSU installation guide - 988-12284-005,
R5000 - System installation manual - 988-12283-005,
R5000 - Processor installation manual - 988-12282-005,
R5000 - Installation manual, S-band down-mast SRT-LAN radar sensor - 988-12285-005,
R5000 - Installation manual, S-Band up-mast SRT-LAN radar sensor - 988-12287-005,
R5000 - Installation manual, X-Band down-mast SRT-LAN radar sensor - 988-12289-005,
R5000 - Installation manual, X-Band up-mast SRT-LAN radar sensor - 988-12291-005,
R5000 - Installation manual, X-Band up-mast HALO 5000 radar sensor - 988-13139-002,
R5000 - Service manual X-Band down-mast SRT-LAN radar sensor - 988-12290-005,
R5000 - Service manual X-Band up-mast SRT-LAN radar sensor - 988-12292-007,
R5000 - Service manual, S-Band down-mast SRT-LAN radar sensor - 988-12286-004,
R5000 - Service manual, S-Band up-mast SRT-LAN radar sensor - 988-12288-005,
R5000 - Service manual, X-band up-mast HALO 5000 radar sensor - 988-13140-002,
R5000 – Installation guide, EDS-405A managed switch - 988-12834-001.*

4. TYPE TEST RECORDS/LABORATORY RECOGNITION STATUS

Performance testing – IEC 62388 Ed. 2.0 (2013-06) incl. Corrigendum 1 (2014), CRS witness test – Montagnana, September 2018, April 2023, October 2023.
Presentation of navigation information – IEC 62288 Ed. 2.0 (2014-07), CRS witness test – Montagnana, September 2018.
Serial interface testing – IEC 61162-1(2016) & IEC 61162-2 Ed. 1.0 (1998), CRS witness test – Montagnana, September 2018.
Environmental testing – IEC 60945 Ed. 4.0 (2002-08) including Corrigendum 1 (2008).
CRS letter of approval – 2211/TSE/VB/031362 dated 2018-09-27.
Bridge alert management testing – IEC 62923-1 Ed. 1.0 (2018) & IEC 62923-2 Ed. 1.0 (2018), Montagnana, June 2021.
Serial interfaces testing – IEC 61162-450 Ed. 2.0 (2018), Montagnana, June 2021.
CRS letter of approval – 1467/TSE/NP/031537 dated 2021-07-12.
CRS letter of approval – 2546/TSE/NP/031608 dated 2023-11-14.
Presentation of navigation information – IEC 62288 Ed. 3.0 (2021-12), CRS witness test – Montagnana, December 2023.
CRS letter of approval – 2808/TSE/NP/031692 dated 2023-12-20.

5. MATERIALS OR COMPONENTS REQUIRED TO BE TYPE APPROVED OR TYPE TESTED

This approval remains valid for subsequent minor software amendments, as allowed by the SW numerical format. Written details of any such modification shall be submitted to and accepted by the approvals authority.

6. OTHER MATERIALS AND/OR COMPONENT

Antennas installations on board HSC vessels include S-Band 12ft antenna and X-Band 4ft, 6ft and 9ft antennas only. The X and S-Band SRT LAN radar sensor can be equipped with antenna group heaters to work in extreme cold environment up to -40°C.

7. PRODUCTION SURVEY REQUIREMENTS

*The manufacturer is allowed to affix the Mark of Conformity to equipment referred and to issue a Declaration of Conformity as long as either of the following is fulfilled:
 Module D – The quality system for production and testing shall be approved by the Notified Body.*

8. ONBOARD INSTALLATION AND MAINTENANCE REQUIREMENTS

The installation on board shall be verified and tested according to Installation & Operation Manual.

9. MARKING AND IDENTIFICATION



Subject to compliance with the conditions in this Schedule of Approval which forms part of certificate, and those of Articles 9, 10 and 15 of the Directive, the Manufacturer is allowed to affix the “Mark of Conformity” to the Product described herein.

xxxx/yy
 xxx - the number of the Notified Body undertaking surveillance module(2489 in case of CRS)
 yy - the last two digits of year mark affixed

This product has been assigned US Coast Guard Module B number **165.115/EC2489/03-001987, 165.116/EC2489/03-001987, 165.117/EC2489/03-001987, 165.216/EC2489/03-001987, 165.217/EC2489/03-001987.** In those instances where the Notified Body conducting the conformity assessment in accordance with either Module D, E or F of the Marine Equipment Directive is not CRS, such Notified Body would use the above U.S. Coast Guard Module B number to provide the manufacturer with the U.S. Coast Guard approval number by noting it on the Certificate of Conformity, thereby authorizing the manufacturer to mark the product accordingly.

10. OTHER

SOFTWARE:

<i>HALO 5000 Transceiver</i>	<i>SRT LAN Transceiver</i>	<i>R5000 Application</i>
<i>9.1.3.xxx</i>	<i>6.1.1.xxx</i>	<i>1.3.xx</i>

APPENDIX – TYPE EXAMINATION DOCUMENTATION AND TEST REPORTS

<i>Document title</i>	<i>Identification number</i>	<i>Revision index</i>
<i>R5000 Radar Processor + O2000 + Trackball + M5027 + R5000 PSU – IEC60945 Ed. 4.0, Test Report – Končar Institute</i>	21580ALL18057en	26.07.2018.
<i>Limited Testing of the R5000 SRT X-Band and S-Band Radar systems – IEC62388 Ed. 2.0, Test Report – TUV SUD</i>	75942092 Report 01 Issue 1	September 2018
<i>Annex to TUV SUD Report, Navico RBU</i>	DRP-FLR-SI-20180920-01	20.09.2018.
<i>Optic tests Display Simrad 27” – INOA</i>	3F-RT16008	July 22, 2016
<i>Optic tests Display Simrad 24” – INOA</i>	3F-RT14009	Sept 26, 2014
<i>Optic tests Display Simrad 19” – INOA</i>	3F-RT14008	Sept 26, 2014
<i>Optic tests Display Simrad 16” – INOA</i>	3F-RT14007	Sept 26, 2014
<i>Wind Tunnel Test on a Radar Scanners X-Band with 12 ft, 9 ft, and 6 ft antenna S-Band with 12 ft antenna, Test Report – Politecnico di Milan</i>	058/16PC	July 26 th 2016
<i>Antenna_Diagram_and_Gain_12 ft S-Band ant. Test Report – SELEX GALILEO</i>	ANT12LP/S0001	10/04/2012
<i>CETECOM – Test report S-BAND UP MAST</i>	1-3423-11-01-10	2012-05-23
<i>CETECOM - Test report S-BAND UP MAST</i>	2-3052-01-02/02	25.11.2002
<i>CETECOM - Test report X-BAND</i>	4-2638-01-04/07	10.08.2007
<i>CETECOM Report – Unwanted emission of S-Band Up Mast Transceiver</i>	1-3423/11-01-10	2012-05-23
<i>SRT 12/002 – SRT 25/002 X-Band Up-Mast, Test report – BSH</i>	BSH/4543/001/4342903/15	February 9, 2015
<i>Test Report on 6ft X-Band antenna Test Report – FINMECCANICA</i>	TR 20160314	March 14, 2016
<i>Test report on 12ft X-Band antenna Test Report – SELEX GALILEO</i>	AH100	March 31, 2008
<i>12 ft S-Band Antenna diagram and gain</i>	ANT12LP-S0001	April 10, 2012
<i>OP40 / O2000 Keyboard – Buzzer test to (IEC 62388 ed.2), Navico Auckland, NZ</i>	DRP-AU-ME-2016-09-30	July 25, 2016
<i>R5000 Radar System - waivers to IEC 60945 ed 4.0 Paragraph 8.10 – Solar radiation Paragraph 8.12 – Corrosion/salt mist Paragraph 12.3 – Emission from visual displays, Paragraph 12.4 – X-Radiation</i>	NAVICO RBU	13.09.2018.
<i>CETECOM – Test report KEYB-002 radar keyboard</i>	1-6492/13-01-02-A 1-6492/13-01-03-A	07.11.2013. 21.11.2013.
<i>NAVICO – Test Report on IEC 61162-450 (2018), IEC 62923-1 (2018) and IEC 62923-2 (2018), CRS witnessed, 2021-06-28</i>	Navico TestLink	27.06.2021. 28.06.2021.

APPENDIX – TYPE EXAMINATION DOCUMENTATION AND TEST REPORTS

<i>Document title</i>	<i>Identification number</i>	<i>Revision index</i>
<i>Halo 2000/3000 Pulse compression radar – IEC60945 Ed. 4.0, Test Report – TIMCO Engineering</i>	<i>TR 2302-22 IEC 60945 HALO 3000</i>	<i>2022-06-27</i>
<i>Halo RI-50 interface module – IEC60945 Ed. 4.0, Test Report – TIMCO Engineering</i>	<i>TR 2302-22 IEC 60945 RI50</i>	<i>2022-06-16</i>
<i>Halo 2000/3000 Pulse compression radar – IEC62388 Ed. 2.0, Test Report – TIMCO Engineering</i>	<i>TR 5475-21 ISED RSS-102/MPE</i>	<i>2022-10-06</i>
<i>Halo 5000 Pulse compression radar – IEC62388 Ed. 2.0, Test Report – CTC Advanced</i>	<i>1-5163</i>	<i>2022-01-02</i>
<i>Halo 5000 Pulse compression radar, RI-50, 6 ft antenna – IEC60945 Ed. 4.0, Test Report – TesLab</i>	<i>22B341F</i>	<i>2023-03-16</i>
<i>Halo 2000/3000 Pulse compression radar – IEC62368-1 Test Report – Austest Lab</i>	<i>1116NAVHALO_368</i>	<i>2022-03-21</i>
<i>HALO 5000 Radar System - waivers to IEC 60945 ed 4.0 Paragraph 8.12 – Corrosion/salt mist Paragraph 12.4 – X-Radiation</i>	<i>NAVICO RBU</i>	<i>2023-07-27</i>
<i>HALO 5000 4 ft antenna – IEC62388 Ed. 2.0, Test report – MVG Italy</i>	<i>TR.259.3.22.ROM</i>	<i>2022-09-16</i>
<i>HALO 5000 6 ft antenna – IEC62388 Ed. 2.0, Test report – MVG Italy</i>	<i>TR.259.5.22.ROM</i>	<i>2022-09-16</i>
<i>HALO 5000, 6 ft antenna – IEC60945 Ed. 4.0, Test report – MATE Advanced Laboratory</i>	<i>N. NAV_080922_01_RP_001_00</i>	<i>2023-04-06</i>
<i>Halo RI-50 interface module – IEC60945 Ed. 4.0, Test Report – MATE Advanced Laboratory</i>	<i>N. NAV_260721_01_RP_001_00</i>	<i>2023-03-17</i>
<i>Halo 5000 X Band radar – IEC62388 Ed. 2.0, Test Report – TUV SUD</i>	<i>75956630-01</i>	<i>2023-10-30</i>
<i>Navico – Test report on IEC 60945 Ed. 4.0</i>	<i>Navico TestRail</i>	<i>2023-10-11</i>
<i>Navico – Test report on IEC 62388 Ed. 2.0</i>	<i>Navico TestRail</i>	<i>2023-10-11</i>
<i>Navico – Test report on IEC 62288 Ed. 3.0</i>	<i>Navico TestRail</i>	<i>2023-12-20</i>

- END OF CERTIFICATE -

ANNEX 1 TO EC TYPE EXAMINATION (MODULE B) CERTIFICATE
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R5000 RADAR SYSTEM COMPONENTS

No	Designation	Unit Description	Type Number
1.1	X-Band Antenna	a) 6 ft. X-BAND ANTENNA b) 9 ft. X-BAND ANTENNA c) 12 ft. X-BAND ANTENNA d) 4 ft. X-BAND HALO ANTENNA e) 6 ft. X-BAND HALO ANTENNA	000-10324-001 000-10325-001 000-10875-001 000-11465-001 000-11466-001
2.1	X-Band Transceiver (up-mast)	a) 12kW SRT X-BAND LAN TRANSCEIVER b) 12kW SRT X-BAND LAN TRANSCEIVER FOR 12FT ANTENNA c) 25kW SRT X-BAND LAN TRANSCEIVER d) 25kW SRT X-BAND LAN TRANSCEIVER FOR 12ft. ANTENNA e) 130W HALO 5000 X-BAND TRANSCEIVER	000-14939-001 000-13218-001 000-13219-001 000-13221-001 000-15742-001
2.2	X-Band Transceiver (up-mast) HSC	a) 12kW SRT X-BAND LAN TRANSCEIVER HSC b) 25kW SRT X-BAND LAN TRANSCEIVER HSC c) 130W HALO 5000 X-BAND TRANSCEIVER	000-13217-001 000-13220-001 000-15742-001
2.3	X-Band Transceiver (down-mast)	X-BAND SRT 25 KW DOWN-MAST W/DOC	000-13319-001
3.1	S-Band Antenna	12 ft. S-BAND ANTENNA	000-11250-001
4.1	S-Band Transceiver (up-mast)	30kW SRT S-BAND LAN TRANSCEIVER	000-13222-001
4.2	S-Band Transceiver (up-mast) HSC	30kW SRT S-BAND LAN TRANSCEIVER HSC	000-13223-001
4.3	S-Band Transceiver (down-mast)	S-BAND SRT 30 KW DOWN-MAST W/DOC	000-13322-001
5.1	X-Band Antenna Pedestal	a) X-BAND SRT ANT PEDESTAL (6&9 ft.) W/DOC b) X-BAND SRT ANT PEDESTAL (12 ft.) W/DOC	000-13316-001 000-13318-001
5.2	X-Band Antenna Pedestal HSC	X-BAND SRT ANTENNA PEDESTAL (6&9 ft.) HSC	000-13317-001
6.1	S-Band Antenna Pedestal	S-BAND SRT ANTENNA PEDESTAL W/DOC	000-13320-001
6.2	S-Band Antenna Pedestal HSC	S-BAND SRT ANTENNA PEDESTAL HSC W/DOC	000-13321-001
7.1	Display Unit 180 mm PPI	a) SIMRAD M5016 MONITOR b) SIMRAD M5019 MONITOR	000-12209-001 000-12210-001
8.1	Display Unit 250 mm PPI	SIMRAD M5024 MONITOR	000-11781-001
9.1	Display Unit 320 mm PPI	SIMRAD M5027 MONITOR	000-12726-001
10.1	Control Unit	a) O2000 RADAR CONTROLLER b) O5000 TRACKBALL and/or c) KEYB-002 MULTI-FUNCTIONAL KEYBOARD	000-13958-001 000-14278-001 000-12450-001
11.1	Processor Unit	R5000 RADAR PROCESSOR	000-13216-001
12.1	Power Supply Unit	a) R5000 220VAC/48VDC POWER SUPPLY b) RI-50 24VDC/48VDC POWER SUPPLY	000-13225-001 000-15757-001
12.2	Power Supply Kit	O2000 ACCESSORY PACK	000-14606-001
13.1	Network Unit	EDS-405A MANAGED SWITCH	000-15936-001

ANNEX 2 TO EC TYPE EXAMINATION (MODULE B) CERTIFICATE
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R5000 RADAR SYSTEM CONFIGURATION TABLE

Radar Cat.	No.	Designation	Type of Radar																			
			1.1	2.1	2.2	2.3	3.1	4.1	4.2	4.3	5.1	5.2	6.1	6.2	7.1	8.1	9.1	10.1	11.1	12.1	13.1	
			X-Band Antenna	X-Band Transceiver (upmast)	X-Band Transceiver (upmast) HSC	X-Band Transceiver (downmast)	S-Band Antenna	S-Band Transceiver (upmast)	S-Band Transceiver (upmast) HSC	S-Band Transceiver (downmast)	X-Band Antenna Pedestal	X-Band Antenna Pedestal HSC	S-Band Antenna Pedestal	S-Band Antenna Pedestal HSC	Display Unit 180 mm PPI	Display Unit 250 mm PPI	Display Unit 320 mm PPI	Control Unit	Processor Unit	Power Supply Unit	Network Unit	
CAT 1		SIMRAD R5027 25D/nX	X			X					X							X	X	X	X	X
		SIMRAD R5027 H500k/v	X	X														X	X	X	X	X
		SIMRAD R5027 25U/nX	X	X														X	X	X	X	X
		SIMRAD R5027 12U/nX	X	X														X	X	X	X	X
		SIMRAD R5027 30D/12S					X			X			X					X	X	X	X	X
		SIMRAD R5027 30U/12S					X	X										X	X	X	X	X
CAT 1H		SIMRAD R5027 25D/mX HSC	X			X						X						X	X	X	X	X
		SIMRAD R5027 H500k/v HSC	X		X													X	X	X	X	X
		SIMRAD R5027 25U/mX HSC	X		X													X	X	X	X	X
		SIMRAD R5027 12U/mX HSC	X		X													X	X	X	X	X
		SIMRAD R5027 30D/12S HSC					X			X				X				X	X	X	X	X
		SIMRAD R5027 30U/12S HSC					X		X									X	X	X	X	X
CAT 2		SIMRAD R5024 25D/nX	X			X					X						X		X	X	X	X
		SIMRAD R5024 H500k/v	X	X													X		X	X	X	X
		SIMRAD R5024 25U/nX	X	X													X		X	X	X	X
		SIMRAD R5024 12U/nX	X	X													X		X	X	X	X
		SIMRAD R5024 30D/12S					X			X			X				X		X	X	X	X
		SIMRAD R5024 30U/12S					X	X									X		X	X	X	X
CAT 2H		SIMRAD R5024 25D/mX HSC	X			X						X					X		X	X	X	X
		SIMRAD R5024 H500k/v HSC	X		X												X		X	X	X	X
		SIMRAD R5024 25U/mX HSC	X		X												X		X	X	X	X
		SIMRAD R5024 12U/mX HSC	X		X												X		X	X	X	X
		SIMRAD R5024 30D/12S HSC					X			X			X				X		X	X	X	X
		SIMRAD R5024 30U/12S HSC					X		X								X		X	X	X	X
CAT 3		SIMRAD R50zz 25D/nX	X			X					X				X			X	X	X	X	X
		SIMRAD R50zz H500k/v	X	X											X			X	X	X	X	X
		SIMRAD R50zz 25U/nX	X	X											X			X	X	X	X	X
		SIMRAD R50zz 12U/nX	X	X											X			X	X	X	X	X
		SIMRAD R50zz 30D/12S					X			X			X					X	X	X	X	X
		SIMRAD R50zz 30U/12S					X	X										X	X	X	X	X

Note: 1) kX = HALO 4X or 6X
 2) mX = 6X or 9X
 3) nX = 6X, 9X or 12X
 4) R50zz = R5016 or R5019
 5) vX = VDC or VAC PSU