



**BUREAU
VERITAS**

Certificate of compliance

Applicant: ZHEJIANG HYXI TECHNOLOGY CO., LTD
9-10F, Building 3, Jiuyao Commercial Center, Zhuantang Street, Xihu District, Hangzhou,
Zhejiang
China

Product: Photovoltaic (PV) inverter

Model: HYX-M2000-SW
HYX-M1800-SW
HYX-M1600-SW
HYX-M2000-S
HYX-M1800-S
HYX-M1600-S

Use in accordance with regulations:

Automatic disconnection device with single-phase mains surveillance in accordance with Engineering Recommendation G98/1 for photovoltaic systems with a single-phase parallel coupling via an inverter in the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter. This serves as a replacement for the disconnection device with isolating function, which can be accessed the distribution network provider at any time.

Applied rules and standards:

Engineering Recommendation G98/1-7:2022

Requirements for the connection of Fully Type Tested Micro-generators (up to and including 16 A per phase) in parallel with public Low Voltage Distribution Networks

DIN V VDE V 0126-1-1:2006 (4.1 Functional safety)

Automatic disconnection device between a generator and the public low-voltage grid

At the time of issue of this certificate, the safety concept of an aforementioned representative product corresponds to the valid safety specifications for the specified use in accordance with regulations.

Report number: CJDJ-ESH-P23090334 **Certification program:** NSOP-0032-DEU-ZE-V01
Certificate number: U23-1055 **Date of issue:** 2023-11-20

Certification body



Domenik Koll
Head of Energy Systems



Certification body Bureau Veritas Consumer Products Services Germany GmbH accredited according to DIN EN ISO/IEC 17065

Testing laboratory accredited according to DIN EN ISO/IEC 17025

A partial representation of the certificate requires the written approval of Bureau Veritas Consumer Products Services Germany GmbH

Appendix C Type Test Verification Report

Extract from test report according to the Engineering Recommendation G98/1

Nr. CJDJ-ESH-P23090334

Type Approval and declaration of compliance with the requirements of Engineering Recommendation G98/1.

| | | | |
|-----------------------|-----------------------------------------------------------------------------------------------------------|----------------|-------------------|
| PGM Technology | Photovoltaic inverter | | |
| Manufacturer | ZHEJIANG HYXI TECHNOLOGY CO., LTD | | |
| Address | 9-10F, Building 3, Jiuyao Commercial Center, Zhuantang Street, Xihu District, Hangzhou, Zhejiang China | | |
| Tel | -- | Fax | -- |
| Email | support@hyxipower.com | Website | www.hyxipower.com |

| Rated values | HYX-M2000-SW | HYX-M1800-SW | HYX-M1600-SW | HYX-M2000-S |
|-----------------------------------|----------------------|--------------|--------------|-------------|
| PV Input (DC) | | | | |
| MPP DC voltage range [V] | 16-60 | | | |
| Input DC voltage range [V] | 16-65 | | | |
| Input DC current [A] | 16/16/16/16 | | | |
| Grid Output (AC) | | | | |
| Output AC voltage [V] | 230, L/N/PE, 50/60Hz | | | |
| Rated AC current [A] | 8,70 | 7,83 | 6,96 | 8,70 |
| Apparent power [VA] | 2000 | 1800 | 1600 | 2000 |

| Rated values | HYX-M1800-S | HYX-M1600-S | -- | -- |
|-----------------------------------|----------------------|-------------|----|----|
| PV Input (DC) | | | | |
| MPP DC voltage range [V] | 16-60 | | -- | -- |
| Input DC voltage range [V] | 16-65 | | -- | -- |
| Input DC current [A] | 16/16/16/16 | | -- | -- |
| Grid Output (AC) | | | | |
| Output AC voltage [V] | 230, L/N/PE, 50/60Hz | | -- | -- |
| Rated AC current [A] | 7,83 | 6,96 | -- | -- |
| Apparent power [VA] | 1800 | 1600 | -- | -- |

Firmware version V01.00.02

Description of the structure of the power generation unit:

The power generation unit is equipped with a PV and line-side EMC filter. The power generation unit has galvanic isolation between DC input and AC output (HF transformer). Output switch-off is performed with single-fault tolerance based on one series-connected relays in (each) line and neutral. This enables a safe disconnection of the power generation unit from the network in case of error.

Differences between Generating Units:

The only difference between model HYX-M2000-SW, HYX-M1800-SW, HYX-M1600-SW and model HYX-M2000-S, HYX-M1800-S, HYX-M1600-S is the product label model and the software, others are the same. Just use different communication methods. So the tests had been performed on model HYX-M2000-SW, HYX-M1800-SW, HYX-M1600-SW.

The tests had been performed on the HYX-M2000-SW, is valid for the HYX-M1800-SW, HYX-M1600-SW since the hardware are similar and just power derated by software.

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The above stated Generating Units are tested according the requirements in the Engineering Recommendation G98/1. Any modification that affects the stated tests must be named by the manufacturer/supplier of the product to ensure that the product meets all requirements of the Engineering Recommendation G98/1.

| Operating Range. | |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test 1 | Voltage = 85% of nominal (195,5 V) Frequency = 47,0 Hz Power Factor = 1 Period of test 20 seconds |
| Connection: | Always connected |
| Limit: | No disconnection allowed |
| Test 2 | Voltage = 85% of nominal (195,5 V) Frequency = 47,5 Hz Power Factor = 1 Period of test 90 minutes |
| Connection: | Always connected |
| Limit: | No disconnection allowed |
| Test 3 | Voltage = 110% of nominal (253 V) Frequency = 51,5 Hz Power Factor = 1 Period of test 90 minutes |
| Connection: | Always connected |
| Limit: | No disconnection allowed |
| Test 4 | Voltage = 110% of nominal (253 V) Frequency = 52,0 Hz Power Factor = 1 Period of test 15 minutes |
| Connection: | Always connected |
| Limit: | No disconnection allowed |
| Test 5 | Voltage = 100% of nominal (230 V) Frequency = 50,0 Hz Power Factor = 1 Period of test 90 minutes |
| Connection: | Always connected |
| Limit: | No disconnection allowed |
| Test 6 | Confirm that the Micro-Generating Plant is capable of staying connected to the Distribution Network and operate at rates of change of frequency up to 1 Hzs-1 as measured over a period of 500 ms. |
| Connection: | Always connected |
| Limit: | No disconnection allowed |



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Protection. Voltage tests.

Phase 1

| Function | Setting | | Trip test | | No trip test | |
|-------------|-------------|----------------|-------------|----------------|----------------|-----------------|
| | Voltage [V] | Time delay [s] | Voltage [V] | Time delay [s] | Voltage / time | Confirm no trip |
| U/V | 184,0 | 2,5 | 184,1 | 2,54 | 188V / 5s | No trip |
| | | | | | 180V / 2,45s | No trip |
| O/V stage 1 | 262,2 | 1,0 | 262,1 | 1,03 | 258,2V / 5,0s | No trip |
| O/V stage 2 | 273,7 | 0,5 | 273,4 | 0,50 | 269,7V / 0,95s | No trip |
| | | | | | 277,7V / 0,45s | No trip |

Note. For Voltage tests the Voltage required to trip is the setting $\pm 3,45V$. The time delay can be measured at a larger deviation than the minimum required to operate the protection. The No trip tests need to be carried out at the setting $\pm 4V$ and for the relevant times as shown in the table above to ensure that the protection will not trip in error.

Protection. Frequency tests.

| Function | Setting | | Trip test | | No trip test | |
|-------------|----------------|----------------|----------------|----------------|------------------|-----------------|
| | Frequency [Hz] | Time delay [s] | Frequency [Hz] | Time delay [s] | Frequency / time | Confirm no trip |
| U/F stage 1 | 47,5 | 20 | 47,50 | 20,00 | 47,7Hz / 30s | No trip |
| U/F stage 2 | 47 | 0,5 | 47,00 | 0,51 | 47,2Hz / 19,5s | No trip |
| | | | | | 46,8Hz / 0,45s | No trip |
| O/F stage 2 | 52 | 0,5 | 52,00 | 0,51 | 51,8Hz / 120s | No trip |
| | | | | | 52,2Hz / 0,45s | No trip |

Note. For Frequency Trip tests the Frequency required to trip is the setting $\pm 0,1Hz$. In order to measure the time delay a larger deviation than the minimum required to operate the projection can be used. The "No-trip tests" need to be carried out at the setting $\pm 0,2Hz$ and for the relevant times as shown in the table above to ensure that the protection will not trip in error.



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Protection. Loss of Mains.

Inverters tested according to BS EN 62116.

| Balancing load on islanded network | 33% of -5% Q Test 22 | 66% of -5% Q Test 12 | 100% of -5% P Test 5 | 33% of +5% Q Test 31 | 66% of +5% Q Test 21 | 100% of +5% P Test 10 |
|------------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|--------------------------|
| Trip time. Ph1 fuse removed [s] | 0,204 | 0,156 | 0,454 | 0,224 | 0,179 | 0,436 |

Note. Trip time limit is 0,5s.

Protection. Re-connection timer.

Test should prove that the reconnection sequence starts in no less than 20 seconds for restoration of voltage and frequency to within the stage 1 settings of table 2.

| Over Voltage | | | | |
|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------|-----------------|-----------------|
| Time delay setting [s] | Measured delay [s] | | | |
| 20 | 31,5 | | | |
| Under Voltage | | | | |
| Time delay setting [s] | Measured delay [s] | | | |
| 20 | 31,0 | | | |
| Over Frequency | | | | |
| Time delay setting [s] | Measured delay [s] | | | |
| 20 | 31,7 | | | |
| Under Frequency | | | | |
| Time delay setting [s] | Measured delay [s] | | | |
| 20 | 31,5 | | | |
| | Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 1. | | | |
| | At 266,2V | At 180,0V | At 47,4Hz | At 52,1Hz |
| Confirmation that the Generating Unit does not re-connect. | No reconnection | No reconnection | No reconnection | No reconnection |

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Protection. Frequency change, Stability test.

| | Start Frequency [Hz] | Change | Test Duration | Confirm no trip |
|--------------------------|----------------------|-------------|---------------|-----------------|
| Positive Vector Shift | 49,5 | +50 degrees | | No trip |
| Negative Vector Shift | 50,5 | -50 degrees | | No trip |
| Positive Frequency drift | 49,0 to 51,0 | +0,95Hz/sec | 2,1s | No trip |
| Negative Frequency drift | 51,0 to 49,0 | -0,95Hz/sec | 2,1s | No trip |

Limited Frequency Sensitive Mode – Over Frequency

| 1-min mean value [Hz]: | a) 50,00 | b) 50,45 | c) 50,70 | d) 51,15 | e) 50,70 | f) 50,45 | g) 50,00 |
|-------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|
| 1. Measurement a) to g): Active power output > 80% P_n | | | | | | | |
| Frequency [Hz]: | 50,00 | 50,45 | 50,70 | 51,15 | 50,70 | 50,45 | 50,00 |
| P _{expected} [W]: | 2000,0 | 1980,0 | 1880,0 | 1700,0 | 1880,0 | 1980,0 | 2000,0 |
| P _{measured} [W]: | 2006,4 | 1976,3 | 1876,3 | 1699,2 | 1877,6 | 1976,0 | 2006,3 |
| 2. Measurement a) to g): Active power output 40% and 60% after freezing > 80% P_n | | | | | | | |
| Frequency [Hz]: | 50,00 | 50,45 | 50,70 | 51,15 | 50,70 | 50,45 | 50,00 |
| P _{expected} [W]: | 1000,0 | 980,0 | 880,0 | 700,0 | 880,0 | 980,0 | 2000,0 |
| P _{measured} [W]: | 1004,4 | 972,9 | 875,2 | 715,6 | 873,3 | 969,8 | 2009,1 |

Output Power with falling Frequency

| 5-min mean value (each) | a) 50 ± 0,01 Hz | b) - 0,4 to - 0,5 Hz | c) - 2,4 to - 2,5 Hz |
|--------------------------|-----------------|----------------------|----------------------|
| Frequency [Hz]: | 50,00 | 49,50 | 47,50 |
| Active power [W]: | 2009,7 | 2010,9 | 2011,5 |
| ΔP/P _{max} [%]: | | | 0,58 |

Note.

No Power reduction takes place for electronic inverter.



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Power Quality. Harmonics.

2000W

Phase 1

| SSEG rating per phase (rpp) | | | | | | |
|-----------------------------|---------------------------------------|-------------------------------|----------------------------------|-------------------------------|---------------------------------------|---------------------------------------------------|
| Harmonic | At 45-55% of rated outputs 1002,3W | | 100% of rated output 2013,6 W | | Limit in BS EN61000-3-2 in Amps | Higher limit for odd harmonics 21 and above |
| | Measured Value (MV) in [A] | Measured Value (MV) in [%] | Measured Value (MV) in [A] | Measured Value (MV) in [%] | | |
| 2nd | 0,007 | 0,076 | 0,039 | 0,451 | 1,080 | |
| 3rd | 0,004 | 0,041 | 0,067 | 0,770 | 2,300 | |
| 4th | 0,004 | 0,044 | 0,027 | 0,316 | 0,430 | |
| 5th | 0,031 | 0,355 | 0,026 | 0,303 | 1,140 | |
| 6th | 0,001 | 0,016 | 0,048 | 0,546 | 0,300 | |
| 7th | 0,027 | 0,307 | 0,028 | 0,318 | 0,770 | |
| 8th | 0,002 | 0,028 | 0,035 | 0,408 | 0,230 | |
| 9th | 0,002 | 0,028 | 0,027 | 0,315 | 0,400 | |
| 10th | 0,003 | 0,040 | 0,021 | 0,243 | 0,184 | |
| 11th | 0,007 | 0,083 | 0,047 | 0,544 | 0,330 | |
| 12th | 0,001 | 0,017 | 0,016 | 0,180 | 0,153 | |
| 13th | 0,007 | 0,082 | 0,049 | 0,559 | 0,210 | |
| 14th | 0,002 | 0,025 | 0,015 | 0,167 | 0,131 | |
| 15th | 0,002 | 0,018 | 0,047 | 0,542 | 0,150 | |
| 16th | 0,002 | 0,019 | 0,014 | 0,156 | 0,115 | |
| 17th | 0,004 | 0,042 | 0,046 | 0,529 | 0,132 | |
| 18th | 0,001 | 0,010 | 0,012 | 0,133 | 0,102 | |
| 19th | 0,004 | 0,041 | 0,036 | 0,413 | 0,118 | |
| 20th | 0,002 | 0,017 | 0,009 | 0,101 | 0,092 | |
| 21th | 0,001 | 0,013 | 0,020 | 0,228 | 0,107 | 0,160 |
| 22th | 0,002 | 0,019 | 0,008 | 0,097 | 0,084 | |
| 23th | 0,003 | 0,037 | 0,013 | 0,153 | 0,098 | 0,147 |
| 24th | 0,001 | 0,006 | 0,008 | 0,093 | 0,077 | |
| 25th | 0,003 | 0,033 | 0,017 | 0,195 | 0,090 | 0,135 |
| 26th | 0,001 | 0,009 | 0,008 | 0,086 | 0,071 | |
| 27th | 0,000 | 0,005 | 0,019 | 0,215 | 0,083 | 0,124 |
| 28th | 0,001 | 0,007 | 0,008 | 0,087 | 0,066 | |
| 29th | 0,002 | 0,023 | 0,012 | 0,140 | 0,078 | 0,117 |
| 30th | 0,000 | 0,004 | 0,008 | 0,088 | 0,061 | |
| 31th | 0,002 | 0,018 | 0,022 | 0,256 | 0,073 | 0,109 |
| 32th | 0,000 | 0,004 | 0,007 | 0,083 | 0,058 | |
| 33th | 0,000 | 0,004 | 0,025 | 0,282 | 0,068 | 0,102 |
| 34th | 0,000 | 0,003 | 0,007 | 0,084 | 0,054 | |
| 35th | 0,001 | 0,007 | 0,023 | 0,260 | 0,064 | 0,096 |
| 36th | 0,000 | 0,003 | 0,007 | 0,082 | 0,051 | |
| 37th | 0,001 | 0,007 | 0,013 | 0,155 | 0,061 | 0,091 |
| 38th | 0,001 | 0,009 | 0,007 | 0,084 | 0,048 | |
| 39th | 0,000 | 0,004 | 0,013 | 0,145 | 0,058 | 0,087 |
| 40th | 0,001 | 0,006 | 0,008 | 0,096 | 0,046 | |

Note the higher limits for odd harmonics 21 and above are only allowable under certain conditions, if these higher limits are utilised please state the exemption used as detailed in part 6.2.3.4 of BS EN 61000-3-2 in the box below.



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Power Quality. Power factor.

| Output power | 216,2V | 230V | 253V | Measured at three voltage levels and at full output. Voltage to be maintained within $\pm 1,5\%$ of the stated level during the test. |
|--------------|--------|--------|--------|---------------------------------------------------------------------------------------------------------------------------------------|
| 20% | 0,9765 | 0,9720 | 0,9618 | |
| 50% | 0,9904 | 0,9896 | 0,9867 | |
| 75% | 0,9939 | 0,9932 | 0,9918 | |
| 100% | 0,9952 | 0,9948 | 0,9939 | |
| Limit | >0,95 | >0,95 | >0,95 | |

Power Quality. Voltage fluctuation and Flicker.

| | Starting | | | Stopping | | | Running | |
|---------------------------------------|---------------|-------------|---------------|---------------|--------------|---------------|---------|-------------|
| | d_{max} [%] | dc [%] | $d_{(t)}$ [%] | d_{max} [%] | dc [%] | $d_{(t)}$ [%] | Pst | Plt 2 hours |
| Measured values at test impedance | 0,350 | 0,094 | 0,00 | 0,393 | 0,123 | 0,00 | 0,189 | 0,160 |
| Measured values at standard impedance | 0,350 | 0,094 | 0,00 | 0,393 | 0,123 | 0,00 | 0,189 | 0,160 |
| Values for maximum impedance | 4,00% | 3,30% | 3,3% 500ms | 4,00% | 3,30% | 3,3% 500ms | 1,00 | 0,650 |
| Limits set under BS EN 61000-3-11 | 4,0 | 3,3 | 3,3 500ms | 4,0 | 3,3 | 3,3 500ms | 1,0 | 0,65 |
| Test impedance | R | 0,24 0,4 | Ω | XI | 0,15 0,25 | Ω | | |
| | Z | | Ω | | | | | |
| Standard impedance | R | 0,24 0,4 | Ω | XI | 0,15 0,25 | Ω | | |
| | Z | | Ω | | | | | |
| Maximum impedance | R | 0,24 0,4 | Ω | XI | 0,15 0,25 | Ω | | |
| | Zmax | | Ω | | | | | |



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Power Quality. DC injection.

Phase 1

| Test level power [%] | 20 | 50 | 75 | 100 |
|----------------------|--------|--------|--------|-------|
| Recorded value [mA] | -1,151 | -1,398 | -1,413 | 0,799 |
| Recorded value [%] | -0,01 | -0,02 | -0,02 | 0,01 |
| Limit [%] | 0,25 | 0,25 | 0,25 | 0,25 |

Note. The Inverter is a single-phase inverter.

Fault level Contribution.

| For a directly coupled SSEG | | | For a Inverter SSEG | | |
|----------------------------------------------------------|----------|-------|---------------------|-----------|----------|
| Parameter | Symbol | Value | Time after fault | Volts [V] | Amps [A] |
| Peak Short Circuit current | I_p | N/A | 20 ms | 23,5 | 694,2 |
| Initial Value of aperiodic current | A | N/A | 100 ms | N/A | N/A |
| Initial symmetrical short-circuit current* | I_k | N/A | 250 ms | N/A | N/A |
| Decaying (aperiodic) component of short circuit current* | i_{DC} | N/A | 500 ms | N/A | N/A |
| Reactance/Resistance Ratio of source* | X/R | N/A | Time to Trip [ms] | 2,65ms | |

For rotating machines and linear piston machines the test should produce a 0s – 2s plot of the short circuit current as seen at the Generating Unit terminals.

* Values for these parameters should be provided where the short circuit duration is sufficiently long to enable interpolation of the plot.

Self Monitoring – Solid state switching.

P

It has been verified that in the event of the solid state switching device failing to disconnect the Generating Unit, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0,5 seconds.

Yes

Note. Unit do not provide solid state switching relays. In case the semiconductor bridge is switched off, then the voltage on the output drops to 0. In this case the relays on the output will also open (Functional safety of the internal automatic disconnection device according to VDE 0126-1-1).

Cyber security

P

Confirm that the Manufacturer or Installer of the Micro-generator has provided a statement describing how the Micro-generator has been designed to comply with cyber security requirements, as detailed in 9.7.

Yes

Note. Different levels of access, all are password protected, only certain parameters can be changed on maintenance level. Manufacturer information provided.

Logic Interface (input port) Required by paragraph 9.4.4

N/A

Confirm that an input port is provided and can be used to reduce the Active Power output to zero

N/A

Note. Manufacturer information provided.

Provide high level description of logic interface, e.g. details in 9.4.4 such as AC or DC signal

N/A



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2.4 Communication Technology

HYX-M2000-SW micro inverter series adopts a new wifi wireless communication solution.

Wi-Fi communication solution: It operates in the 2.4GHz frequency band, and the transmission distance is weaker than the Sub-1G frequency band. It does not need additional communication equipment and can directly communicate with Hxyi Cloud.

HYX-M2000-SW, HYX-M1800-SW, HYX-M1600-SW

2.4 Communication Technology

1-in-4 Sub-1G version series micro inverters adopt a new Sub-1GHz wireless communication solution.

HYX-M2000-S, HYX-M1800-S, HYX-M1600-S

Note:

The device is a microinverter without any logic interface. The user is provided with module-level monitoring through the web or app application to realize remote operation and maintenance