

**Form A2-4: Site Compliance and Commissioning test requirements for Type A Power Generating Modules**

This form should be completed if site compliance tests are being undertaken for some or all of the **Interface Protection** where it is **Not Type Tested** and for other compliance tests that have been identified in Form 2-1, Form 2-2 or Form 2-3 as being undertaken on site.

**Product Details:**

|                  |  |
|------------------|--|
| Model            | IntyeliPro Mains Decoupling Relay.<br>Compliant with engineering Recommendation G99 Issue 1 Amendment 5 November 2019. |
| Part Number      | InteliPro - G99  |
| Software Version | 1.9.0  |
| Date             | 5 February 2020  |
| G99 Version      | G99/1.5  |

**Manufactures details:**

|                      |  |
|----------------------|--|
| Name                 | ComAp a.s.   |
| Address              | U Uranie 1612/14a<br>Prague 7 170 00<br>Czech Republic |
| Responsible Engineer | Ing. Vladimir Zubak<br>Ing. Michal Rybka               |

| Requirement   | Compliance by provision of <b>Manufacturers Information</b> or type test reports.<br>Reference number should be detailed, and <b>Manufacturers Information</b> attached. | Compliance by commissioning tests<br>Tick if true and complete relevant sections of form below |
|---|--|--|
| Over and under voltage protection <b>LV</b> –calibration test | Type Test as Detailed Below  |  |
| Over and under voltage protection <b>LV</b> –stability test   | Type Test as Detailed Below  |  |
| Over and under voltage protection <b>HV</b> –calibration test | Type Test as Detailed Below  |  |

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|  |  |  |
|--|--|--|
| Over and under voltage protection <b>HV</b> – stability test | Type Test as Detailed Below                          |  |
| Over and Under Frequency protection – calibration test       | Type Test as Detailed Below                          |  |
| Over and Under Frequency protection - stability test         | Type Test as Detailed Below                          |  |
| Loss of mains protection – calibration test                  | Type Test as Detailed Below                          |  |
| Loss of mains protection – stability test                    | Type Test as Detailed Below                          |  |
| Wiring functional tests: If required by para 15.2.1          | Not Applicable to this protection relay<br>Type Test |  |

### Over and Under Voltage Protection Tests LV

Where the **Connection Point** is at **LV** the **Generator** shall demonstrate compliance with this EREC 1 Amendment 5 of the G99 in respect of Over and Under Voltage Protection by provision of **Manufacturers Information, Type Test** reports or by undertaking the following tests on site.

### Calibration and Accuracy Tests

| Phase                | Setting                 | Time Delay | Pickup Voltage |                |             |        | Relay Operating Time - step from 230 V to test value |             |                |             |        |
|----------------------|-------------------------|------------|----------------|----------------|-------------|--------|--|-------------|----------------|-------------|--------|
| Stage 1 Over Voltage |                         |            | Lower Limit    | Measured Value | Upper Limit | Result | Test Value   | Lower Limit | Measured Value | Upper Limit | Result |
| L1 - N               | 262.2 V<br>230 V system | 1.0 s      | 258.75         | 260.81         | 265.65      | Pass   | 266.2  | 1.0 s       | 1.002          | 1.1 s       | Pass   |
| L2 - N               |                         |            |                | 260.81         |             | Pass   |  |             | 1.012          |             | Pass   |
| L3 - N               |                         |            |                | 260.81         |             | Pass   |  |             | 1.010          |             | Pass   |
| Stage 2 Over Voltage |                         |            | Lower Limit    | Measured Value | Upper Limit | Result | Test Value   | Lower Limit | Measured Value | Upper Limit | Result |
| L1 - N               | 273.7 V<br>230 V system | 0.5s       | 270.25         | 273.48         | 277.15      | Pass   | 277.7  | 0.5 s       | 0.504          | 0.6 s       | Pass   |
| L2 - N               |                         |            |                | 273.48         |             | Pass   |  |             | 0.513          |             | Pass   |
| L3 - N               |                         |            |                | 274.15         |             | Pass   |  |             | 0.508          |             | Pass   |

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| Under Voltage |                         |       | Lower Limit | Measured Value | Upper Limit |      | Test Value | Lower Limit | Measured Value | Upper Limit | Result |
|---------------|-------------------------|-------|-------------|----------------|-------------|------|------------|-------------|----------------|-------------|--------|
| L1 - N        | 184.0 V<br>230 V system | 2.5 s | 180.55      | 183.08         | 187.45      | Pass | 180        | 2.5 s       | 2.508          | 2.6 s       | Pass   |
| L2 - N        |                         |       |             | 183.62         |             |      |            |             | 2.503          |             | Pass   |
| L3 - N        |                         |       |             | 183.08         |             |      |            |             | 2.504          |             | Pass   |

| Over and Under Voltage Protection Tests LV  |         |            |                                |                              |   |                 |        |
|---|---------|------------|--------------------------------|------------------------------|---|-----------------|--------|
| Stability Tests   |         |            |                                |                              |   |                 |        |
| Test Description  | Setting | Time Delay | Test Condition (3-Phase Value) | Test Voltage all phases ph-n | Test Duration                             | Confirm No Trip | Result |
| Inside Normal band  | -----   | -----      | < OV Stage 1                   | 258.2 V                      | 5.00 s                                    | No Trip         | Pass   |
| Stage 1 Over Voltage  | 262.2 V | 1.0 s      | > OV Stage 1                   | 269.7 V                      | 0.95 s                                    | No Trip         | Pass   |
| Stage 2 Over Voltage  | 273.7 V | 0.5 s      | > OV Stage 2                   | 277.7 V                      | 0.45 s                                    | No Trip         | Pass   |
| Inside Normal band  | -----   | -----      | > UV                           | 188 V                        | 5.00 s                                    | No Trip         | Pass   |
| Under Voltage   | 184.0 V | 2.5 s      | < UV                           | 180 V                        | 2.45 s                                    | No Trip         | Pass   |
| Overvoltage test - Voltage shall be stepped from 258 V to the test voltage and held for the test duration and then stepped back to 258 V.<br>Undervoltage test – Voltage shall be stepped from 188 V to the test voltage and held for the test duration and then stepped back to 188 V                        |         |            |                                |                              |   |                 |        |
| Additional Comments / Observations:   |         |            |                                |                              |   |                 |        |
|   |         |            |                                |                              |   |                 |        |
| Over and Under Voltage Protection Tests HV  |         |            |                                |                              |   |                 |        |
| Where the <b>Connection Point</b> is at <b>HV</b> the <b>Generator</b> shall demonstrate compliance with the EREC 1 Amendment 5 of the G99 in respect of Over and Under Voltage Protection by provision of <b>Manufacturers Information, Type Test</b> reports or by undertaking the following tests on site. |         |            |                                |                              |   |                 |        |
| Over and Under Voltage Protection HV  |         |            |                                |                              |   |                 |        |
| Tests referenced to 110 V ph-ph VT output   |         |            |                                |                              |   |                 |        |
| Calibration and Accuracy Tests.   |         |            |                                |                              |   |                 |        |
| Phase   | Setting | Time Delay | Pickup Voltage                 |                              | Relay Operating Time measured value ± 2 V |                 |        |

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| Stage 1 Over Voltage  |                               |              | Lower Limit                    | Measured Value                 | Upper Limit   | Result          | Test Value               | Lower Limit | Measured Value | Upper Limit | Result |
|---|-------------------------------|--------------|--------------------------------|--------------------------------|---------------|-----------------|--------------------------|-------------|----------------|-------------|--------|
| L1 - L2   | 121 V<br>110 V VT secondary   | 1.0 s        | 119.35                         | 121.49                         | 122.65        | Pass            | Measured value plus 2 V  | 1.0 s       | 1.060          | 1.1 s       | Pass   |
| L2 - L3   |                               |              |                                | 121.49                         |               | Pass            |                          |             | 1.060          |             | Pass   |
| L3 - L1   |                               |              |                                | 121.59                         |               | Pass            |                          |             | 1.060          |             | Pass   |
| Stage 2 Over Voltage  |                               |              | Lower Limit                    | Measured Value                 | Upper Limit   | Result          | Test Value               | Lower Limit | Measured Value | Upper Limit | Result |
| L1 - L2   | 124.3 V<br>110 V VT secondary | 0.5 s        | 122.65                         | 124.82                         | 125.95        | Pass            | Measured value plus 2 V  | 0.5 s       | 0.506          | 0.6 s       | Pass   |
| L2 - L3   |                               |              |                                | 124.82                         |               | Pass            |                          |             | 0.511          |             | Pass   |
| L3 - L1   |                               |              |                                | 124.82                         |               | Pass            |                          |             | 0.501          |             | Pass   |
| Under Voltage   |                               |              | Lower Limit                    | Measured Value                 | Upper Limit   | Result          | Test Value               | Lower Limit | Measured Value | Upper Limit | Result |
| L1 - L2   | 88.0 V<br>110 V VT secondary  | 2.5s         | 86.35                          | 86.46                          | 89.65         | Pass            | Measured value minus 2 V | 2.5 s       | 2.510          | 2.6 s       | Pass   |
| L2 - L3   |                               |              |                                | 86.46                          |               | Pass            |                          |             | 2.511          |             | Pass   |
| L3 - L1   |                               |              |                                | 86.46                          |               | Pass            |                          |             | 2.510          |             | Pass   |
| <b>Over and Under Voltage Protection Tests HV</b><br>referenced to 110 V ph-ph VT output. |                               |              |                                |                                |               |                 |                          |             |                |             |        |
| <b>Stability Tests.</b>   |                               |              |                                |                                |               |                 |                          |             |                |             |        |
| Test Description  | Setting                       | Time Delay   | Test Condition (3-Phase Value) | Test Voltage All phase s ph-ph | Test Duration | Confirm No Trip | Result                   |             |                |             |        |
| Inside Normal band  | -----                         | -----        | < OV Stage 1                   | 119 V                          | 5.00 s        | No Trip         | Pass                     |             |                |             |        |
| <b>Stage 1 Over Voltage</b>   | <b>121 V</b>                  | <b>1.0 s</b> | > OV Stage 1                   | 122.3 V                        | 0.95 s        | No Trip         | Pass                     |             |                |             |        |
| <b>Stage 2 Over Voltage</b>   | <b>124.3 V</b>                | <b>0.5 s</b> | > OV Stage 2                   | 126.3 V                        | 0.45 s        | No Trip         | Pass                     |             |                |             |        |
| Inside Normal band  | -----                         | -----        | > UV                           | 90 V                           | 5.00 s        | No Trip         | Pass                     |             |                |             |        |
| <b>Under Voltage</b>  | <b>88 V</b>                   | <b>2.5 s</b> | < UV                           | 86 V                           | 2.45 s        | No Trip         | Pass                     |             |                |             |        |
| Additional Comments / Observations:   |                               |              |                                |                                |               |                 |                          |             |                |             |        |

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| <b>Over and Under Frequency Protection.</b>   |            |                  |                |             |                |                      |                 |                |             |        |
|---|------------|------------------|----------------|-------------|----------------|----------------------|-----------------|----------------|-------------|--------|
| The <b>Generator</b> shall demonstrate compliance with the EREC 1 Amendment 5 of the G99 in respect of Over and Under Frequency Protection by provision of <b>Manufacturers Information, Type Test</b> or by undertaking the following tests on site. |            |                  |                |             |                |                      |                 |                |             |        |
| <b>Calibration and Accuracy Tests.</b>  |            |                  |                |             |                |                      |                 |                |             |        |
| Setting   | Time Delay | Pickup Frequency |                |             |                | Relay Operating Time |                 |                |             |        |
| Over Frequency  |            | Lower Limit      | Measured Value | Upper Limit | Result         | Freq step            | Lower Limit     | Measured Value | Upper Limit | Result |
| 52 Hz   | 0.5 s      | 51.90            | <b>52.06</b>   | 52.10       | Pass/Fail      | 51.7-52.3 Hz         | 0.50 s          | <b>0.50</b>    | 0.60 s      | Pass   |
| Stage 1 Under Frequency   |            | Lower Limit      | Measured Value | Upper Limit | Result         | Freq step            | Lower Limit     | Measured Value | Upper Limit | Result |
| 47.5 Hz   | 20         | 47.40            | <b>47.46</b>   | 47.60       | Pass/Fail      | 47.8-47.2 Hz         | 20.0 s          | <b>20.00</b>   | 20.2 s      | Pass   |
| Stage 2 Under Frequency   |            | Lower Limit      | Measured Value | Upper Limit | Result         | Freq step            | Lower Limit     | Measured Value | Upper Limit | Result |
| 47 Hz   | 0.5 s      | 46.90            | <b>46.96</b>   | 47.1        | Pass/Fail      | 47.3-46.7 Hz         | 0.50 s          | <b>0.506</b>   | 0.60 s      | Pass   |
| <b>Stability Tests.</b>   |            |                  |                |             |                |                      |                 |                |             |        |
| Test Description  | Setting    | Time Delay       | Test Condition |             | Test Frequency | Test Duration        | Confirm No Trip | Result         |             |        |
| Inside Normal band  | -----      | -----            | < OF           |             | 51.3 Hz        | 120 s                | <b>No Trip</b>  | <b>Pass</b>    |             |        |
| <b>Over Frequency</b>   | 52 Hz      | 0.5 s            | > OF           |             | 52.2 Hz        | 0.45 s               | <b>No Trip</b>  | <b>Pass</b>    |             |        |
| Inside Normal band  | -----      | -----            | > UF Stage 1   |             | 47.7 Hz        | 30 s                 | <b>No Trip</b>  | <b>Pass</b>    |             |        |
| <b>Stage 1 Under Frequency</b>  | 47.5 Hz    | 20 s             | < UF Stage 1   |             | 47.3 Hz        | 19.5 s               | <b>No Trip</b>  | <b>Pass</b>    |             |        |
| <b>Stage 2 Under Frequency</b>  | 47 Hz      | 0.5 s            | < UF Stage 2   |             | 46.8 Hz        | 0.45 s               | <b>No Trip</b>  | <b>Pass</b>    |             |        |
| Over frequency test - Frequency shall be stepped from 51.8 Hz to the test frequency and held for the test duration and then stepped back to 51.8 Hz.  |            |                  |                |             |                |                      |                 |                |             |        |
| Under frequency test - Frequency shall be stepped from 47.7 Hz to the test frequency and held for the test duration and then stepped back to 47.7 Hz.   |            |                  |                |             |                |                      |                 |                |             |        |
| Additional Comments / Observations:   |            |                  |                |             |                |                      |                 |                |             |        |
|   |            |                  |                |             |                |                      |                 |                |             |        |

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| Details of Loss of Mains Protection. |                     |                      |          |                   |
|--------------------------------------|---------------------|----------------------|----------|-------------------|
| Manufacturer                         | Manufacturer's type | Date of Installation | Settings | Other information |
|                                      |                     |                      |          |                   |

**Loss-of-Mains (LOM) Protection Tests.**  
The **Generator** shall demonstrate compliance with this EREC 1 Amendment 5 of the G99 in respect of LOM Protection by either providing the **DNO** with appropriate **Manufacturers' Information, Type Test** or by undertaking the following tests on site

**Calibration and Accuracy Tests.**

| Ramp in range 49.0-51.0 Hz      | Pickup ( $\pm 0.025$ Hzs <sup>-1</sup> ) |                |             |             | Relay Operating Time RoCoF= $\pm 0.10$ Hzs <sup>-1</sup> above setting |             |                |             |             |
|---------------------------------|--|----------------|-------------|-------------|--|-------------|----------------|-------------|-------------|
| Setting = 1.0 Hzs <sup>-1</sup> | Lower Limit                              | Measured Value | Upper Limit | Result      | Test Condition   | Lower Limit | Measured Value | Upper Limit | Result      |
| Increasing Frequency            | 0.975                                    | 1.01           | 1.025       | <b>Pass</b> | 1.10 Hzs <sup>-1</sup>   | >0.5 s      | 0.780          | <1.0 s      | <b>Pass</b> |
| Reducing Frequency              | 0.975                                    | 0.975          | 1.025       | <b>Pass</b> | 1.10 Hzs <sup>-1</sup>   | >0.5 s      | 0.653          | <1.0 s      | <b>Pass</b> |
| Ramp in range 48.5-51.5 Hz      | Pickup ( $\pm 0.025$ Hzs <sup>-1</sup> ) |                |             |             | Relay Operating Time RoCoF= $\pm 0.10$ Hzs <sup>-1</sup> above setting |             |                |             |             |
| Setting = 1.0 Hzs <sup>-1</sup> | Lower Limit                              | Measured Value | Upper Limit | Result      | Test Condition   | Lower Limit | Measured Value | Upper Limit | Result      |
| Increasing Frequency            | 0.975                                    | 0.998          | 1.025       | <b>Pass</b> | 3.00 Hzs <sup>-1</sup>   | >0.5 s      | 0.692          | <1.0 s      | <b>Pass</b> |
| Reducing Frequency              | 0.975                                    | 1.019          | 1.025       | <b>Pass</b> | 3.00 Hzs <sup>-1</sup>   | >0.5 s      | 0.683          | <1.0 s      | <b>Pass</b> |

**Stability Tests.**

| Ramp in range 49.0-51.0 Hz | Test Condition         | Test frequency ramp     | Test Duration | Confirm No Trip | Result      |
|----------------------------|------------------------|-------------------------|---------------|-----------------|-------------|
| Inside Normal band         | < RoCoF (increasing f) | +0.95 Hzs <sup>-1</sup> | 2.1 s         | <b>No Trip</b>  | <b>Pass</b> |
| Inside Normal band         | < RoCoF (reducing f)   | -0.95 Hzs <sup>-1</sup> | 2.1 s         | <b>No Trip</b>  | <b>Pass</b> |

**Ramp as Shown**

|                    |                        |  |       |                |             |
|--------------------|------------------------|--|-------|----------------|-------------|
| Inside Normal band | < RoCoF (increasing f) | +1.20 Hzs <sup>-1</sup> Ramp between 49.80Hz and 50.34Hz | 0.45s | <b>No Trip</b> | <b>Pass</b> |
| Inside Normal band | < RoCoF (reducing f)   | -1.20 Hzs <sup>-1</sup> Ramp between 50.30Hz and 49.76Hz | 0.45s | <b>No Trip</b> | <b>Pass</b> |

|   |                 |              |                 |
|---|-----------------|--------------|-----------------|
| Additional Comments / Observations:   |                 |              |                 |
|   |                 |              |                 |
| <b>LoM Protection - Stability test.</b>   |                 |              |                 |
|   | Start Frequency | Change       | Confirm no trip |
| Positive Vector Shift   | 49.5 Hz         | +50 degrees  | <b>No Trip</b>  |
| Negative Vector Shift   | 50.5 Hz         | - 50 degrees | <b>No Trip</b>  |
| <b>Wiring functional tests:</b>   |                 |              |                 |
| If required by para 15.2.1, confirm that wiring functional tests have been carried out in accordance with the instructions below  |                 | <b>N/A</b>   |                 |
| <p>Where components of a <b>Power Generating Module</b> are separately <b>Type Tested</b> and assembled into a <b>Power Generating Module</b>, if the connections are made via loose wiring, rather than specifically designed error-proof connectors, then it will be necessary to prove the functionality of the components that rely on the connections that have been made by the loose wiring.</p> <p>As an example, consider a <b>Type Tested</b> alternator complete with its control systems etc. It needs to be connected to a <b>Type Tested Interface Protection</b> unit. In this case there are only three voltage connections to make, and one tripping circuit. The on-site checks need to confirm that the <b>Interface Protection</b> sees the correct three phase voltages and that the tripping circuit is operative. It is not necessary to inject the <b>Interface Protection</b> etc to prove this. Simple functional checks are all that are required.</p> <p>Test schedule:</p> <ul style="list-style-type: none"> <li>With <b>Generating Unit</b> running and energised, confirm L1, L2, L3 voltages on <b>Generating Unit</b> and on <b>Interface Protection</b>.</li> <li>Disconnect one phase of the control wiring at the <b>Generating Unit</b>. Confirm received voltages at the <b>Interface Protection</b> have one phase missing.</li> <li>Repeat for other phases.</li> <li>Confirm a trip on the Interface Protection trips the Generating Unit.</li> </ul> |                 |              |                 |
|   |                 |              |                 |
| Insert here any additional tests which have been carried out (as identified as being required by Form A2-1, A2-2 or A2-3)   |                 |              |                 |

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