

Esders JSON Protocol (Version 2)

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Introduction

The “Esders JSON Protocol” is a simple communication protocol, which can be used to read stored measurements and live menu data from Esders instruments. This document describes version 2 of the protocol and is not compatible with devices that support only version 1.

Requirements

To be able to use this communication protocol, following requirements have to be satisfied:

- Instrument supports the JSON Protocol
- Instrument supports communication via Bluetooth
- “JSON” option is enabled
- Instrument is set to “JSON” mode

Connection

Data is transmitted via Bluetooth. The first step in establishing a connection is determining the MAC address by scanning for available Bluetooth devices (depends on used hardware and software). Every Esders instrument identifies itself using its serial number according to following naming pattern “Esders 123/45678 “, with “123/45678” being the serial number.

After determining the MAC address the connection can be established. A simple serial communication is used to send commands and receive the responses.

The device might show a connection error in following situations:

- If a Bluetooth connection is active before the device is set into JSON transfer mode. The device thinks that a connection using our internal protocol is active and refuses to cancel this connection. The correct order is first setting the device into JSON transfer mode and then starting the Bluetooth connection.
- The format of the jmf command might be wrong, i.e. the command is not send in the format 'jmf="yyyymmdd/hhmmss"'.
The correct format is: `jmf="yyyymmdd/hhmmss"`
- An invalid measurement (date, time) is used with the jmf command.
- JSON output might not be supported for a specific type of measurement.
- If the device is set to JSON transfer mode using the memory menu (memory -> measurement -> options -> JSON transfer), the currently selected measurement can't be read using the jmf command. The jms command has to be used in that case.
- If a command is not supported by the connected device or active menu the device returns “null”.

Commands

Each command line consists of the prefix “+” (ASCII 43), a body and the line feed character “\n” (ASCII 10) as terminator. The body is a string of characters in the ASCII range 32-255.

+jdi\n – JSON Device Information

Prints device information, like serial number and software version. Can be used to identify the connected device.

Requirements: Communication mode json has to be activated.

+jms\n – JSON Measurement Selected

Prints the json information of the selected measurement. The json-response depends on the selected measurement. Command is not available for all device and menus.

Requirements: A measurement has to be selected in the memory menu and the option “print to json” has to be chosen.

+jml\n – JSON Measurement List

Lists the measurement files of the device. The json-response contains a list of all files grouped by date. To build the list the device needs some time. The json object contains an array for each day. For each file the start time of the measurement and the file size is listed.

Requirements: The menu “Bluetooth connection” has to be chosen.

Example response:

```
{
  "20190313": [
    {"time": "141401", "size": 577},
    {"time": "141926", "size": 4307}
  ],
  "20190314": [
    {"time": "145657", "size": 287}
  ]
}
```

On the example device three measurements are stored:

1. 13.03.2019 14:14:01
2. 13.03.2019 14:19:26
3. 14.03.2019 14:56:57

+jmf="<date>/<start_time>"\n – JSON Measurement File

Prints the json information of the specified measurement. Command is not available for all device and menus.

The json-response depends on the menu.

Requirements: The menu “Bluetooth connection” has to be chosen.

Param	Description
<date>	Date of the measurement in the format yearmonthday
<start_time>	Start time of the measurement in the format hoursminutesseconds

+jpc\n – JSON Menu Configuration

Command prints the configuration of the active menu. The main output of this command is “mconfig” and depends on device and menu.

Requirements: The menu has to support this command and automatic changing of the communication mode has to be enabled.

+jps\n – JSON Menu State

Command prints the state of the active menu. The main output of this command is “mstate” and depends on device and menu.

Requirements: The menu has to support this command and automatic changing of the communication mode has to be enabled.

JSON data structure

Following example shows the data structure send by the instrument. Depending on the device and command, some fields might not be present. To identify the measurement type (i.e. the menu type) the “menu_no” field should be used.

```
{
  "version": 2,                // Protocol version
  "device": {                 // Device information
    "serialno": "110/12345",   // Serial number
    "swversion": 10,          // Software version
    "time": "2019-03-14T12:38:22", // Current device time (ISO 8601)
    "man": "Esders GmbH",     // Manufacturer
    "dev": "DrukTest Max",    // Device type
    "battery": 70,            // State of charge of the battery [%]
    "servicedate": "2019-11-01" // Date of next service
  },
  "header": {                 // Measurement header
    "time_start": "2019-03-13T08:12:01", // Start time of measurement; null if not yet started
    "menu_no": 55,            // Menu ID (unique per measurement type)
    "menu_name": "G-07 Inneninstallation" // Translated menu name
  },
  "mde": {                    // User configurable text fields; see later chapter
  },
  "results": {                // Results are device and measurement dependent; see later chapter
  },
  "mconfig": {                // Menu configuration is device and menu dependent; see later chapter
  },
  "mstate": {                 // Menu state is device and menu dependent; see later chapter
  }
}
```

JSON “mde” data

Most measurement types allow the entry of user configurable text and data fields. These have to be configured via PC software prior to the measurement. At the end of every measurement of this type, the user can enter data for the previously configured fields. Possible field types are text, drop-down, checkbox and signature. The entered data will be part of the JSON data. Since all texts are user configurable, there can't be fixed keys. Instead the configured label will be used as a key. Following example shows the structure of the “mde” fields.

```
"mde": {
  "Name": "Max Mustermann", // Text field
  "Address": null,          // Unedited fields may contain null
}
```

```

"Regulator type": "RF-12", // Drop-down field; value stored as string
"Optical inspection": true, // Checkbox may be null, true or false
"Signature": true // Image not accessible via JSON, only info if entered or not
}

```

JSON “results” data

While the general structure of the measurement data is described in the previous chapter, there are parts of the data, which are dependent on the device and measurement type. Following chapters describe the data format for the different supported devices and measurements. The data format that is described here will be located in the “results” field of the top object.

Measurements are often split into phases (e.g. stabilization phase...). This structure is represented in the format of the results. A single result field, e.g. “p_start”, is dependent on the phase and could represent the pressure at the start of the measurement or the pressure at the start of the corresponding phase.

Individual results and phases may be missing from the measurement data under certain conditions. This could, for example, happen, if a phase is manually skipped by the user, or if the configuration is changed so some part of the measurement is not executed.

Result fields are usually in the form of key-value, with value being a “simple value” (int, float, bool...). However, more complex data may be represented with complex data structures. Common exceptions are values with a corresponding unit. These are represented as arrays of two elements, with the first element being the actual value and the second element being the unit. A list of all available units can be found in the chapter “Units”. Usually fields are stored in a “base unit”, e.g. hPa for pressure or °C for temperature.

To increase readability of these example outputs some comments have been added (C style using //). These will not be part of the device output. Also some constants may be written as symbols instead of integers (e.g. units).

GasTest delta3 (Serial: 100/xxxxx)

Building inspection (Menu ID: 15)

```

"results": {
  "result": {
    "g_max": [150, JSON_UNITS_PPM], // Maximum gas value
    "t_max": "2019-05-20T12:53:39", // Time of maximum value
    "sn_sensor": "800/02875" // Serial number of external sensor
  }
}

```

Pressure test free (Menu ID: 10, 11)

```

"results": {
  "phase0": {
    "sn_sensor": "810/02859",
    "is_gauge_pressure": True
  },
  "stabilization": {
    "p_max": [691, JSON_UNITS_HPA],
    "runtime": [60, JSON_UNITS_SEC]
  },
  "measurement": {
    "p_start": [684, JSON_UNITS_HPA],
    "p_end": [682, JSON_UNITS_HPA],
    "p_diff": [2, JSON_UNITS_HPA],
    "p_min": [681, JSON_UNITS_HPA],
    "p_max": [684, JSON_UNITS_HPA],
    "p_avg": [682.7662354, JSON_UNITS_HPA],
    "runtime": [60, JSON_UNITS_SEC],
    "allowed_drop": [25, JSON_UNITS_HPA]
  }
}

```

```

"result": {
  "result": 3      // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK
}
}

```

B3 service line G 459-1 (Menu ID: 50)

```

"results": {
  "phase0": {
    "sn_sensor": "810/02859"
  },
  "pressure_rise": {
    "runtime": [17, JSON_UNITS_SEC],
    "p_max": [904, JSON_UNITS_HPA]
  },
  "stabilization": {
    "runtime": [300, JSON_UNITS_SEC],
    "p_max": [889, JSON_UNITS_HPA]
  },
  "measurement": {
    "p_start": [861, JSON_UNITS_HPA],
    "p_end": [854, JSON_UNITS_HPA],
    "p_diff": [7, JSON_UNITS_HPA],
    "p_min": [853, JSON_UNITS_HPA],
    "p_max": [861, JSON_UNITS_HPA],
    "p_avg": [856.1251831, JSON_UNITS_HPA],
    "p_allowed_drop": [50, JSON_UNITS_HPA],
    "temp_start": [25.97089767, JSON_UNITS_C],
    "temp_end": [26.07734299, JSON_UNITS_C],
    "runtime": [600, JSON_UNITS_SEC]
  },
  "result": {
    "result": 3      // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK
  }
}

```

EWE service line (Menu ID: 45)

```

"results": {
  "phase0": {
    "pipe_data": [{
      "dn": [32, JSON_UNITS_MM],
      "length": [1.25, JSON_UNITS_M],
      "sdr": 11,
      "volume": [0.0006729759043, JSON_UNITS_L],
      "material": "PE 100 SDR 11"
    }],
    "mop": [1000, 10],
    "volume": [0.6729758978, JSON_UNITS_L],
    "sn_sensor": "810/02860"
  },
  "loadtest": {
    "p_start": [3235, JSON_UNITS_HPA],
    "p_end": [3215, JSON_UNITS_HPA],
    "p_max": [3240, JSON_UNITS_HPA],
    "runtime": [900, JSON_UNITS_SEC],
    "runtime_target": [900, JSON_UNITS_SEC]
  },
  "contraction": {
    "p_start": [870, JSON_UNITS_HPA],
    "p_end": [885, JSON_UNITS_HPA],
    "p_max": [885, JSON_UNITS_HPA],
    "runtime": [300, JSON_UNITS_SEC],
    "runtime_target": [300, JSON_UNITS_SEC]
  },
  "tightness": {
    "p_start": [885, JSON_UNITS_HPA],
    "p_end": [885, JSON_UNITS_HPA],
    "p_diff": [0, JSON_UNITS_HPA],
    "p_max": [890, JSON_UNITS_HPA],
    "p_allowed_drop": [30, JSON_UNITS_HPA],
    "temp_start": [26.32558632, JSON_UNITS_C],
    "temp_end": [26.56875038, JSON_UNITS_C],
    "runtime": [1800, JSON_UNITS_SEC],
    "runtime_target": [1800, JSON_UNITS_SEC]
  },
  "result": {
    "result": 3      // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK
  }
}

```

```
}
}
```

Avacon/WEVG service line (Menu ID: 48, 66)

```
"results": {
  "phase0": {
    "pipe_data": [{
      "dn": [32, JSON_UNITS_MM],
      "length": [72.80000305, JSON_UNITS_M],
      "sdr": 11,
      "volume": [0.03919411823, JSON_UNITS_L],
      "material": "PE 100 SDR 11"
    }, {
      "dn": [63, JSON_UNITS_MM],
      "length": [25.20000076, JSON_UNITS_M],
      "sdr": 11,
      "volume": [0.0525861308, JSON_UNITS_L],
      "material": "PE 100 SDR 11"
    }],
    "mop": [1000, JSON_UNITS_HPA],
    "volume": [91.78024292, JSON_UNITS_L],
    "is_pvc": false,
    "sn_sensor": "810/02860"
  },
  "loadtest": {
    "p_start": [6165, JSON_UNITS_HPA],
    "p_end": [6140, JSON_UNITS_HPA],
    "p_max": [6165, JSON_UNITS_HPA],
    "runtime": [300, JSON_UNITS_SEC],
    "runtime_target": [300, JSON_UNITS_SEC]
  },
  "stabilize": {
    "p_start": [3115, JSON_UNITS_HPA],
    "p_end": [3115, JSON_UNITS_HPA],
    "p_max": [3120, JSON_UNITS_HPA],
    "runtime": [900, JSON_UNITS_SEC],
    "runtime_target": [900, JSON_UNITS_SEC]
  },
  "tightness": {
    "p_start": [3110, JSON_UNITS_HPA],
    "p_end": [3110, JSON_UNITS_HPA],
    "p_diff": [0, JSON_UNITS_HPA],
    "p_min": [3110, JSON_UNITS_HPA],
    "p_max": [3110, JSON_UNITS_HPA],
    "p_allowed_drop": [7, JSON_UNITS_HPA],
    "p_diff_result": [0, JSON_UNITS_HPA],
    "temp_start": [26.76640701, JSON_UNITS_C],
    "temp_end": [26.76640701, JSON_UNITS_C],
    "cnt_repetitions": 1,
    "runtime": [3, JSON_UNITS_SEC],
    "runtime_target": [900, JSON_UNITS_SEC]
  },
  "result": {
    "result": 2 // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK
  }
}
```

Load test / Gastightness test (Menu ID: 8, 9, 14, 32, 33, 34)

```
"results": {
  "loadtest": {
    "p_start": [1012, JSON_UNITS_HPA],
    "p_end": [1004, JSON_UNITS_HPA],
    "p_diff": [8, JSON_UNITS_HPA],
    "p_min": [1004, JSON_UNITS_HPA],
    "p_max": [1013, JSON_UNITS_HPA],
    "p_avg": [1009, JSON_UNITS_HPA],
    "p_resolution": [1, JSON_UNITS_HPA],
    "runtime": [180, JSON_UNITS_SEC],
    "runtime_target": [180, JSON_UNITS_SEC],
    "result": 2 // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK
  },
  "tightness": {
    "p_start": [150.8000031, JSON_UNITS_HPA],
    "p_end": [150.9000092, JSON_UNITS_HPA],
    "p_diff": [-0.1000061035, JSON_UNITS_HPA],
    "p_min": [150.8000031, JSON_UNITS_HPA],

```



```

    "p_max": [150.9000092, JSON_UNITS_HPA],
    "p_avg": [150.9000092, JSON_UNITS_HPA],
    "p_resolution": [1, JSON_UNITS_HPA],
    "stabil_runtime": [60, JSON_UNITS_SEC],
    "stabil_runtime_target": [60, JSON_UNITS_SEC],
    "runtime": [60, JSON_UNITS_SEC],
    "runtime_target": [60, JSON_UNITS_SEC],
    "result": 3 // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK
}
}

```

Serviceability test (Menu ID: 6, 7, 30, 31)

```

"results": {
  "phase0": {
    "volume": [100, JSON_UNITS_L],
    "p_op": [27, JSON_UNITS_HPA],
    "p_ref": [23, JSON_UNITS_HPA]
  },
  "stabilization": {
    "runtime": [120, JSON_UNITS_SEC],
    "runtime_target": [600, JSON_UNITS_SEC]
  },
  "measurement": {
    "runtime": [300, JSON_UNITS_SEC],
    "runtime_target": [300, JSON_UNITS_SEC],
    "p_min": [26.96162224, JSON_UNITS_HPA],
    "p_max": [27.04652977, JSON_UNITS_HPA],
    "p_avg": [27.00017929, JSON_UNITS_HPA],
    "flow_min": [-0.01225277875, JSON_UNITS_L_H],
    "flow_max": [-0.00220345892, JSON_UNITS_L_H],
    "flow_avg": [-0.006475519855, JSON_UNITS_L_H],
    "flow_norm": [-0.005516147241, JSON_UNITS_L_H],
    "volume_floor": [0, JSON_UNITS_L],
    "volume_ceil": [5, JSON_UNITS_L],
    "result": 6, // Values: 1:=No evaluation, 2:=Cancelled, 9:=Unstable data,
                //          10:=Pressure low, 5:=Below level 1, 6:=Below level 2,
                //          7:=Below level 3, 8:=Above level 3
    "result_str": "Unbeschränkt gebrauchsfähig!" // Translated result string
  }
}

```

Regulator test (Menu ID: 12, 16)

```

"results": {
  "phase0": {
    "p_outlet": [21.37493515, JSON_UNITS_HPA],
    "p_closure": [25.76558113, JSON_UNITS_HPA],
    "sbv_react": [null, JSON_UNITS_HPA],
    "sav_u_c": [73.52903748, JSON_UNITS_HPA],
    "sav_u_c2": [null, JSON_UNITS_HPA],
    "sav_u_c3": [null, JSON_UNITS_HPA],
    "sav_l_c": [null, JSON_UNITS_HPA],
    "gdr_cl_t": 3, // Values: 1:=No evaluation, 3:=OK, 4:=Not OK
    "gms": 4, // Values: 1:=No evaluation, 3:=OK, 4:=Not OK
    "sbv_cl_t": 1, // Values: 1:=No evaluation, 3:=OK, 4:=Not OK
    "sav_cl_t": 3 // Values: 1:=No evaluation, 3:=OK, 4:=Not OK
  }
}

```

Regulator test external (Menu ID: 13)

```

"results": {
  "phase0": {
    "p_outlet": [962.2196655, JSON_UNITS_HPA],
    "p_closure": [1030.831909, JSON_UNITS_HPA],
    "sbv_react": [null, JSON_UNITS_HPA],
    "sbv_cl_t": 1, // Values: 1:=No evaluation, 3:=OK, 4:=Not OK
    "gdr_cl_t": 4, // Values: 1:=No evaluation, 3:=OK, 4:=Not OK
    "sav1_u_c1": [2489.762207, JSON_UNITS_HPA],
    "sav1_u_c2": [null, JSON_UNITS_HPA],
    "sav1_u_c3": [null, JSON_UNITS_HPA],
    "sav1_cl_t": 3, // Values: 1:=No evaluation, 3:=OK, 4:=Not OK
    "sav1_l_c": [null, JSON_UNITS_HPA],
    "sav2_u_c1": [2489.762207, JSON_UNITS_HPA],
    "sav2_u_c2": [null, JSON_UNITS_HPA],
    "sav2_u_c3": [null, JSON_UNITS_HPA],
    "sav2_cl_t": 3, // Values: 1:=No evaluation, 3:=OK, 4:=Not OK
  }
}

```

```

    "sav2_l_c": [null, JSON_UNITS_HPA],
    "sav3_u_c1": [2489.762207, JSON_UNITS_HPA],
    "sav3_u_c2": [null, JSON_UNITS_HPA],
    "sav3_u_c3": [null, JSON_UNITS_HPA],
    "sav3_cl_t": 3, // Values: 1:=No evaluation, 3:=OK, 4:=Not OK
    "sav3_l_c": [null, JSON_UNITS_HPA],
    "sn_sensor": "810/02860"
  }
}

```

smart memo (Serial: 140/xxxxx)

Pressure test free (Menu ID: 29)

```

"results": {
  "phase0": {
    "sn_sensor": "810/02859",
    "sn_sensor_temp": "810/04125", // Temperature sensor
    "type_sensor_temp": 6, // Values: 5:=Generic Temp., 6:=Contact Temp., 7:=Ground Temp.
    "location_lat": 52.6,
    "location_long": 7.4,
    "is_gauge_pressure": True
  },
  "stabilization": {
    "p_max": [691, JSON_UNITS_HPA],
    "runtime": [60, JSON_UNITS_SEC]
  },
  "measurement": {
    "p_start": [684, JSON_UNITS_HPA],
    "p_end": [682, JSON_UNITS_HPA],
    "p_diff": [2, JSON_UNITS_HPA],
    "p_min": [681, JSON_UNITS_HPA],
    "p_max": [684, JSON_UNITS_HPA],
    "p_avg": [682.7662354, JSON_UNITS_HPA],
    "runtime": [60, JSON_UNITS_SEC],
    "allowed_drop": [25, JSON_UNITS_HPA]
  },
  "result": {
    "result": 3 // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK
  }
}

```

B3 service line G 459-1 (Menu ID: 50)

```

"results": {
  "phase0": {
    "sn_sensor": "810/02859",
    "sn_sensor_temp": "810/04125", // Temperature sensor
    "type_sensor_temp": 6, // Values: 5:=Generic Temp., 6:=Contact Temp., 7:=Ground Temp.
    "location_lat": 52.6,
    "location_long": 7.4
  },
  "pressure_rise": {
    "runtime": [17, JSON_UNITS_SEC],
    "p_max": [904, JSON_UNITS_HPA]
  },
  "stabilization": {
    "runtime": [300, JSON_UNITS_SEC],
    "p_max": [889, JSON_UNITS_HPA]
  },
  "measurement": {
    "p_start": [861, JSON_UNITS_HPA],
    "p_end": [854, JSON_UNITS_HPA],
    "p_diff": [7, JSON_UNITS_HPA],
    "p_min": [853, JSON_UNITS_HPA],
    "p_max": [861, JSON_UNITS_HPA],
    "p_avg": [856.1251831, JSON_UNITS_HPA],
    "p_allowed_drop": [50, JSON_UNITS_HPA],
    "temp_start": [25.97089767, JSON_UNITS_C],
    "temp_end": [26.07734299, JSON_UNITS_C],
    "runtime": [600, JSON_UNITS_SEC]
  },
  "result": {
    "result": 3 // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK
  }
}

```

B3 supply line (Menu ID: 51), B3 testing (Poland) (Menu ID: 64)

```

"results": {
  "phase0": {
    "pipe_data": [{
      "id": [32, JSON_UNITS_MM],
      "length": [1.25, JSON_UNITS_M],
      "volume": [0.0006729759043, JSON_UNITS_L]
    }],
    "mop": [1.0, JSON_UNITS_BAR],
    "volume": [0.6729758978, JSON_UNITS_L],
    "covered": true,
    "sn_sensor": "810/02859",
    "sn_sensor_temp": "810/04125", // Temperature sensor
    "type_sensor_temp": 6, // Values: 5:=Generic Temp., 6:=Contact Temp., 7:=Ground Temp.
    "location_lat": 52.6,
    "location_long": 7.4
  },
  "stabilization": {
    "p_start": [3235, JSON_UNITS_HPA],
    "p_end": [3215, JSON_UNITS_HPA],
    "p_max": [3240, JSON_UNITS_HPA],
    "runtime": [900, JSON_UNITS_SEC],
    "runtime_target": [900, JSON_UNITS_SEC]
  },
  "measurement": {
    "p_start": [3110, JSON_UNITS_HPA],
    "p_end": [3110, JSON_UNITS_HPA],
    "p_diff": [0, JSON_UNITS_HPA],
    "p_min": [3110, JSON_UNITS_HPA],
    "p_max": [3110, JSON_UNITS_HPA],
    "p_avg": [3110, JSON_UNITS_HPA],
    "p_allowed_drop": [30, JSON_UNITS_HPA],
    "temp_start": [26.32558632, JSON_UNITS_C],
    "temp_end": [26.56875038, JSON_UNITS_C],
    "runtime": [1800, JSON_UNITS_SEC],
    "runtime_target": [1800, JSON_UNITS_SEC]
  },
  "result": {
    "result": 3 // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK,
              // 12:=Unstable Data, 14:=Pressure too low
  }
}

```

EWE service line (Menu ID: 45)

```

"results": {
  "phase0": {
    "pipe_data": [{
      "dn": [32, JSON_UNITS_MM],
      "length": [1.25, JSON_UNITS_M],
      "sdr": 11,
      "volume": [0.0006729759043, JSON_UNITS_L],
      "material": "PE 100 SDR 11"
    }],
    "mop": [1000, 10],
    "volume": [0.6729758978, JSON_UNITS_L],
    "sn_sensor": "810/02860",
    "sn_sensor_temp": "810/04125", // Temperature sensor
    "type_sensor_temp": 6, // Values: 5:=Generic Temp., 6:=Contact Temp., 7:=Ground Temp.
    "location_lat": 52.6,
    "location_long": 7.4
  },
  "loadtest": {
    "p_start": [3235, JSON_UNITS_HPA],
    "p_end": [3215, JSON_UNITS_HPA],
    "p_max": [3240, JSON_UNITS_HPA],
    "runtime": [900, JSON_UNITS_SEC],
    "runtime_target": [900, JSON_UNITS_SEC]
  },
  "contraction": {
    "p_start": [870, JSON_UNITS_HPA],
    "p_end": [885, JSON_UNITS_HPA],
    "p_max": [885, JSON_UNITS_HPA],
    "runtime": [300, JSON_UNITS_SEC],
    "runtime_target": [300, JSON_UNITS_SEC]
  },
  "tightness": {

```

```

    "p_start": [885, JSON_UNITS_HPA],
    "p_end": [885, JSON_UNITS_HPA],
    "p_diff": [0, JSON_UNITS_HPA],
    "p_max": [890, JSON_UNITS_HPA],
    "p_allowed_drop": [30, JSON_UNITS_HPA],
    "temp_start": [26.32558632, JSON_UNITS_C],
    "temp_end": [26.56875038, JSON_UNITS_C],
    "runtime": [1800, JSON_UNITS_SEC],
    "runtime_target": [1800, JSON_UNITS_SEC]
  },
  "result": {
    "result": 3      // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK
  }
}

```

EWE supply line (Menu ID: 46)

```

"results": {
  "phase0": {
    "pipe_data": [{
      "dn": [32, JSON_UNITS_MM],
      "length": [1.25, JSON_UNITS_M],
      "sdr": 11,
      "volume": [0.0006729759043, JSON_UNITS_L],
      "material": "PE 100 SDR 11"
    }],
    "mop": [1000, 10],
    "volume": [0.6729758978, JSON_UNITS_L],
    "sn_sensor": "810/02860",
    "sn_sensor_temp": "810/04125", // Temperature sensor
    "type_sensor_temp": 6, // Values: 5:=Generic Temp., 6:=Contact Temp., 7:=Ground Temp.
    "location_lat": 52.6,
    "location_long": 7.4
  },
  "loadtest": {
    "p_start": [3235, JSON_UNITS_HPA],
    "p_end": [3215, JSON_UNITS_HPA],
    "p_max": [3240, JSON_UNITS_HPA],
    "runtime": [900, JSON_UNITS_SEC],
    "runtime_target": [900, JSON_UNITS_SEC]
  },
  "contraction": {
    "p_start": [870, JSON_UNITS_HPA],
    "p_end": [885, JSON_UNITS_HPA],
    "p_max": [885, JSON_UNITS_HPA],
    "runtime": [300, JSON_UNITS_SEC],
    "runtime_target": [300, JSON_UNITS_SEC]
  },
  "tightness": {
    "p_start": [885, JSON_UNITS_HPA],
    "p_end": [885, JSON_UNITS_HPA],
    "p_diff": [0, JSON_UNITS_HPA],
    "p_max": [890, JSON_UNITS_HPA],
    "p_allowed_drop": [30, JSON_UNITS_HPA],
    "temp_start": [26.32558632, JSON_UNITS_C],
    "temp_end": [26.56875038, JSON_UNITS_C],
    "runtime": [1800, JSON_UNITS_SEC],
    "runtime_target": [1800, JSON_UNITS_SEC]
  },
  "result": {
    "result": 3      // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK
  }
}

```

Avacon/WEVG service line (Menu ID: 48, 66)

```

"results": {
  "phase0": {
    "pipe_data": [{
      "dn": [32, JSON_UNITS_MM],
      "length": [72.80000305, JSON_UNITS_M],
      "sdr": 11,
      "volume": [0.03919411823, JSON_UNITS_L],
      "material": "PE 100 SDR 11"
    }], {
      "dn": [63, JSON_UNITS_MM],

```

```

    "length": [25.20000076, JSON_UNITS_M],
    "sdr": 11,
    "volume": [0.0525861308, JSON_UNITS_L],
    "material": "PE 100 SDR 11"
  }],
  "mop": [1000, JSON_UNITS_HPA],
  "volume": [91.78024292, JSON_UNITS_L],
  "is_pvc": false,
  "sn_sensor": "810/02860",
  "sn_sensor_temp": "810/04125", // Temperature sensor
  "type_sensor_temp": 6, // Values: 5:=Generic Temp., 6:=Contact Temp., 7:=Ground Temp.
  "location_lat": 52.6,
  "location_long": 7.4
},
"loadtest": {
  "p_start": [6165, JSON_UNITS_HPA],
  "p_end": [6140, JSON_UNITS_HPA],
  "p_max": [6165, JSON_UNITS_HPA],
  "runtime": [300, JSON_UNITS_SEC],
  "runtime_target": [300, JSON_UNITS_SEC]
},
"stabilize": {
  "p_start": [3115, JSON_UNITS_HPA],
  "p_end": [3115, JSON_UNITS_HPA],
  "p_max": [3120, JSON_UNITS_HPA],
  "runtime": [900, JSON_UNITS_SEC],
  "runtime_target": [900, JSON_UNITS_SEC]
},
"tightness": {
  "p_start": [3110, JSON_UNITS_HPA],
  "p_end": [3110, JSON_UNITS_HPA],
  "p_diff": [0, JSON_UNITS_HPA],
  "p_min": [3110, JSON_UNITS_HPA],
  "p_max": [3110, JSON_UNITS_HPA],
  "p_allowed_drop": [7, JSON_UNITS_HPA],
  "p_diff_result": [0, JSON_UNITS_HPA],
  "temp_start": [26.76640701, JSON_UNITS_C],
  "temp_end": [26.76640701, JSON_UNITS_C],
  "cnt_repetitions": 1,
  "runtime": [3, JSON_UNITS_SEC],
  "runtime_target": [900, JSON_UNITS_SEC]
},
"result": {
  "result": 2 // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK
}
}

```

Avacon/WEVG supply line (Menu ID: 49, 67)

```

"results": {
  "phase0": {
    "pipe_data": [
      {
        "dn": [32, JSON_UNITS_MM],
        "length": [72.80000305, JSON_UNITS_M],
        "sdr": 11,
        "volume": [0.03919411823, JSON_UNITS_L],
        "material": "PE 100 SDR 11"
      },
      {
        "dn": [63, JSON_UNITS_MM],
        "length": [25.20000076, JSON_UNITS_M],
        "sdr": 11,
        "volume": [0.0525861308, JSON_UNITS_L],
        "material": "PE 100 SDR 11"
      }
    ],
    "mop": [1000, JSON_UNITS_HPA],
    "volume": [91.78024292, JSON_UNITS_L],
    "is_pvc": false,
    "sn_sensor": "810/02860",
    "sn_sensor_temp": "810/04125", // Temperature sensor
    "type_sensor_temp": 6, // Values: 5:=Generic Temp., 6:=Contact Temp., 7:=Ground Temp.
    "location_lat": 52.6,
    "location_long": 7.4
  },
  "loadtest": {
    "p_start": [6165, JSON_UNITS_HPA],
    "p_end": [6140, JSON_UNITS_HPA],
    "p_max": [6165, JSON_UNITS_HPA],
    "runtime": [300, JSON_UNITS_SEC],

```

```

    "runtime_target": [300, JSON_UNITS_SEC]
  },
  "stabilize": {
    "p_start": [3115, JSON_UNITS_HPA],
    "p_end": [3115, JSON_UNITS_HPA],
    "p_max": [3120, JSON_UNITS_HPA],
    "runtime": [900, JSON_UNITS_SEC],
    "runtime_target": [900, JSON_UNITS_SEC]
  },
  "tightness": {
    "p_start": [3110, JSON_UNITS_HPA],
    "p_end": [3110, JSON_UNITS_HPA],
    "p_diff": [0, JSON_UNITS_HPA],
    "p_min": [3110, JSON_UNITS_HPA],
    "p_max": [3110, JSON_UNITS_HPA],
    "p_allowed_drop": [7, JSON_UNITS_HPA],
    "p_diff_result": [0, JSON_UNITS_HPA],
    "temp_start": [26.76640701, JSON_UNITS_C],
    "temp_end": [26.76640701, JSON_UNITS_C],
    "cnt_repetitions": 1,
    "runtime": [3, JSON_UNITS_SEC],
    "runtime_target": [900, JSON_UNITS_SEC]
  },
  "result": {
    "result": 2 // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK
  }
}

```

W 400 contraction procedure (Menu ID: 58), W 101 contraction procedure (Menu ID: 63)

```

"results": {
  "phase0": {
    "pipe_data": [{
      "dn": [32, JSON_UNITS_MM],
      "length": [1.25, JSON_UNITS_M],
      "sdr": 11,
      "volume": [0.0006729759043, JSON_UNITS_L],
      "material": "PE 100 SDR 11"
    }],
    "sn_sensor": "810/02860",
    "sn_sensor_temp": "810/00815",
    "type_sensor_temp": 6, // Values: 5:=Generic Temp., 6:=Contact Temp., 7:=Ground Temp.
    "location_lat": 52.6,
    "location_long": 7.4
  },
  "stabilization": {
    "p_end": [885, JSON_UNITS_HPA],
    "runtime": [900, JSON_UNITS_SEC]
  },
  "pressure_buildup": {
    "runtime": [900, JSON_UNITS_SEC]
  },
  "pressure_hold": {
    "runtime": [900, JSON_UNITS_SEC]
  },
  "preliminary_test": {
    "runtime": [300, JSON_UNITS_SEC],
    "p_start": [1000, JSON_UNITS_HPA],
    "p_end": [950, JSON_UNITS_HPA],
    "p_diff_rel": [5.0, JSON_UNITS_PERCENT]
  },
  "pressure_drop": {
    "runtime": [1800, JSON_UNITS_SEC],
    "p_reduct": [885, JSON_UNITS_HPA],
    "p_end": [885, JSON_UNITS_HPA],
    "v_allowed": [885, JSON_UNITS_L],
    "v_drained": [885, JSON_UNITS_L]
  },
  "main_test": {
    "runtime": [1800, JSON_UNITS_SEC],
    "p_max": [885, JSON_UNITS_HPA],
    "p_end": [885, JSON_UNITS_HPA],
    "p_diff_mt30": [885, JSON_UNITS_HPA]
  },
  "main_test_ext": {
    "runtime": [1800, JSON_UNITS_SEC],
    "p_end": [885, JSON_UNITS_HPA],
    "p_diff_mt90": [885, JSON_UNITS_HPA]
  }
}

```

```

},
"temperatures": {
  "temp_start": [21.12345678, JSON_UNITS_C],
  "temp_end": [21.87654321, JSON_UNITS_C]
},
"result": {
  "result": 3          // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK
                    //          13:= v_drained not OK
}
}

```

W 400 accelerated standard procedure (Menu ID: 60)

```

"results": {
  "phase0": {
    "pipe_data": [{
      "dn": [32, JSON_UNITS_MM],
      "length": [1.25, JSON_UNITS_M],
      "volume": [0.0006729759043, JSON_UNITS_L],
      "material": "Stahl mit ZMA"
    }],
    "sn_sensor": "810/02860",
    "sn_sensor_temp": "810/00815",
    "type_sensor_temp": 6,    // Values: 5:=Generic Temp., 6:=Contact Temp., 7:=Ground Temp.
    "location_lat": 52.6,
    "location_long": 7.4
  },
  "saturation": {
    "runtime": [900, JSON_UNITS_SEC]
  },
  "pressure_drop": {
    "v_required": [885, JSON_UNITS_L],
    "v_drained": [885, JSON_UNITS_L],
    "p_start": [3110, JSON_UNITS_HPA],
    "p_end": [3110, JSON_UNITS_HPA],
    "p_diff": [0, JSON_UNITS_HPA],
    "p_diff_min": [0, JSON_UNITS_HPA]
  },
  "main_test": {
    "runtime": [1800, JSON_UNITS_SEC],
    "p_start": [885, JSON_UNITS_HPA],
    "p_end": [885, JSON_UNITS_HPA],
    "p_diff": [885, JSON_UNITS_HPA],
    "allowed_drop": [123.45, JSON_UNITS_HPA]
  },
  "temperatures": {
    "temp_start": [21.12345678, JSON_UNITS_C],
    "temp_end": [21.87654321, JSON_UNITS_C]
  },
  "result": {
    "result": 3          // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK,
                    //          16:=OK with deviations
  }
}

```

W 400 standard procedure (Menu ID: 59), W 400 impact-minimized standard procedure (Menu ID: 65), W 101 standard procedure (Menu ID: 62)

```

"results": {
  "phase0": {
    "pipe_data": [{
      "dn": [32, JSON_UNITS_MM],
      "s": [2.909, JSON_UNITS_MM],
      "length": [123.45, JSON_UNITS_M],
      "volume": [66.4631072223, JSON_UNITS_L],
      "material": "PE 100 SDR 11"
    }],
    "sn_sensor": "810/02860",
    "sn_sensor_temp": "810/00815",
    "type_sensor_temp": 6,    // Values: 5:=Generic Temp., 6:=Contact Temp., 7:=Ground Temp.
    "location_lat": 52.6,
    "location_long": 7.4
  },
  "pressure_buildup": {
    "runtime": [900, JSON_UNITS_SEC]
  },
  "preliminary_test": {

```

```

    "runtime": [3600, JSON_UNITS_SEC],
    "p_test": [15000.0, JSON_UNITS_HPA],
  },
  "pressure_drop": {
    "runtime": [345, JSON_UNITS_SEC],
    "p_start": [14980.0, JSON_UNITS_HPA],
    "p_end": [14450.0, JSON_UNITS_HPA],
    "p_reduct": [530, JSON_UNITS_HPA],
    "p_reduct_target": [500, JSON_UNITS_HPA],
    "v_drained": [1.650, JSON_UNITS_L]
    "v_allowed": [2.922, JSON_UNITS_L],
  },
  "pressure_restore": { // optional
    "runtime": [900, JSON_UNITS_SEC]
  },
  "preliminary_test_continued": { // optional
    "runtime": [3614, JSON_UNITS_SEC],
    "runtime_total": [3614, JSON_UNITS_SEC],
  },
  "pressure_lowering": { // optional
    "runtime": [900, JSON_UNITS_SEC]
  },
  "main_test": {
    "runtime": [10800, JSON_UNITS_SEC],
    "runtime_target": [10800, JSON_UNITS_SEC],
    "p_test": [13000.0, JSON_UNITS_HPA],
    "p_start": [12980.0, JSON_UNITS_HPA],
    "p_max": [13100.0, JSON_UNITS_HPA], // only, when plasticity-tubes
    "p_end": [12950.0, JSON_UNITS_HPA],
    "p_diff": [150.0, JSON_UNITS_HPA]
    "allowed_drop": [100.0, JSON_UNITS_HPA]
  },
  "main_test_ext": { // only in W 400 impact-minimized standard procedure
    "runtime": [1800, JSON_UNITS_SEC],
    "runtime_target": [1800, JSON_UNITS_SEC],
    "p_end": [12920.0, JSON_UNITS_HPA],
    "p_diff_ext": [180.0, JSON_UNITS_HPA]
    "allowed_drop": [200.0, JSON_UNITS_HPA]
  },
  "temperatures": {
    "temp_start": [21.12345678, JSON_UNITS_C],
    "temp_end": [21.87654321, JSON_UNITS_C]
  },
  "result": {
    "result": 3 // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK
              // 13:=v_drained not OK 16:=OK with deviation
  }
}

```

Regulator test external (Menu ID: 13)

```

"results": {
  "phase0": {
    "p_outlet": [962.2196655, JSON_UNITS_HPA],
    "p_closure": [1030.831909, JSON_UNITS_HPA],
    "sbv_react": [null, JSON_UNITS_HPA],
    "sbv_cl_t": 1, // Values: 1:=No evaluation, 3:=OK, 4:=Not OK
    "gdr_cl_t": 4, // Values: 1:=No evaluation, 3:=OK, 4:=Not OK
    "sav1_u_c1": [2489.762207, JSON_UNITS_HPA],
    "sav1_u_c2": [null, JSON_UNITS_HPA],
    "sav1_u_c3": [null, JSON_UNITS_HPA],
    "sav1_cl_t": 3, // Values: 1:=No evaluation, 3:=OK, 4:=Not OK
    "sav1_l_c": [null, JSON_UNITS_HPA],
    "sav2_u_c1": [2489.762207, JSON_UNITS_HPA],
    "sav2_u_c2": [null, JSON_UNITS_HPA],
    "sav2_u_c3": [null, JSON_UNITS_HPA],
    "sav2_cl_t": 3, // Values: 1:=No evaluation, 3:=OK, 4:=Not OK
    "sav2_l_c": [null, JSON_UNITS_HPA],
    "sav3_u_c1": [2489.762207, JSON_UNITS_HPA],
    "sav3_u_c2": [null, JSON_UNITS_HPA],
    "sav3_u_c3": [null, JSON_UNITS_HPA],
    "sav3_cl_t": 3, // Values: 1:=No evaluation, 3:=OK, 4:=Not OK
    "sav3_l_c": [null, JSON_UNITS_HPA],
    "sn_sensor": "810/02860"
  }
}

```


SIA 190 air (Menu ID: 73), VSA air (Menu ID: 74)

```

"results": {
  "phase0": {
    "pipe_data": [{
      "id": [26.2, JSON_UNITS_MM],
      "length": [123.45, JSON_UNITS_M],
    }],
    "p_test": [15000.0, JSON_UNITS_HPA],
    "sn_sensor": "810/02859",
    "sn_sensor_temp": "810/04125", // Temperature sensor
    "type_sensor_temp": 6, // Values: 5:=Generic Temp., 6:=Contact Temp., 7:=Ground Temp.
    "location_lat": 52.6,
    "location_long": 7.4
  },
  "stabilization": {
    "p_start": [3235, JSON_UNITS_HPA],
    "p_end": [3215, JSON_UNITS_HPA],
    "runtime": [900, JSON_UNITS_SEC],
    "runtime_target": [900, JSON_UNITS_SEC]
  },
  "measurement": {
    "p_start": [3110, JSON_UNITS_HPA],
    "p_end": [3110, JSON_UNITS_HPA],
    "p_diff": [0, JSON_UNITS_HPA],
    "p_allowed_drop": [30, JSON_UNITS_HPA],
    "p_min": [3110, JSON_UNITS_HPA],
    "p_max": [3110, JSON_UNITS_HPA],
    "runtime": [1800, JSON_UNITS_SEC],
    "runtime_target": [1800, JSON_UNITS_SEC]
    "temp_start": [26.32558632, JSON_UNITS_C],
    "temp_end": [26.56875038, JSON_UNITS_C],
  },
  "result": {
    "result": 3 // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK,
              // 12:=Unstable Data, 14:=Pressure too low
  }
}

```

SVGW G2 service line (Menu ID: 76), SVGW G2 supply line (Menu ID: 77)

```

"results": {
  "phase0": {
    "pipe_data": [{
      "id": [32, JSON_UNITS_MM],
      "length": [1.25, JSON_UNITS_M],
      "volume": [0.0006729759043, JSON_UNITS_L]
      "material": "Stahl"
    }],
    "mop": [1.0, JSON_UNITS_BAR],
    "volume": [0.6729758978, JSON_UNITS_L],
    "covered": true,
    "sn_sensor": "810/02859",
    "sn_sensor_temp": "810/04125", // Temperature sensor
    "type_sensor_temp": 6, // Values: 5:=Generic Temp., 6:=Contact Temp., 7:=Ground Temp.
    "location_lat": 52.6,
    "location_long": 7.4
  },
  "stabilization": {
    "p_start": [3235, JSON_UNITS_HPA],
    "p_end": [3215, JSON_UNITS_HPA],
    "p_max": [3240, JSON_UNITS_HPA],
    "runtime": [900, JSON_UNITS_SEC],
    "runtime_target": [900, JSON_UNITS_SEC]
  },
  "measurement": {
    "p_start": [3110, JSON_UNITS_HPA],
    "p_end": [3110, JSON_UNITS_HPA],
    "p_diff": [0, JSON_UNITS_HPA],
    "p_min": [3110, JSON_UNITS_HPA],
    "p_max": [3110, JSON_UNITS_HPA],
    "p_allowed_drop": [30, JSON_UNITS_HPA],
    "temp_start": [26.32558632, JSON_UNITS_C],
    "temp_end": [26.56875038, JSON_UNITS_C],
    "runtime": [1800, JSON_UNITS_SEC],
    "runtime_target": [1800, JSON_UNITS_SEC]
  },
  "result": {

```

```

    "result": 3          // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK,
                        //          12:=Unstable Data, 14:=Pressure too low
  }
}

```

LD PE (Menu ID: 79), MD PE (Menu ID: 80) and MD ST (Menu ID: 81)

```

"results": {
  "phase0": {
    "pipe_data": [{
      "dn": [63, JSON_UNITS_MM],
      "length": [1.25, JSON_UNITS_M],
      "volume": [0.0006729759043, JSON_UNITS_L],
      "material": "Stahl"
      "dn_string": "63 (PE)"
    }],
    "sn_sensor": "810/02859",
    "sn_sensor_temp": "810/04125", // Temperature sensor
    "type_sensor_temp": 6, // Values: 5:=Generic Temp., 6:=Contact Temp., 7:=Ground Temp.
    "location_lat": 52.6,
    "location_long": 7.4
  },
  "pressure_buildup": {
    "runtime": [123, JSON_UNITS_SEC]
  },
  "saturation": {
    "p_start": [3235, JSON_UNITS_HPA],
    "p_end": [3215, JSON_UNITS_HPA],
    "runtime": [900, JSON_UNITS_SEC],
    "runtime_target": [900, JSON_UNITS_SEC]
  },
  "main_test": {
    "p_start": [3110, JSON_UNITS_HPA],
    "p_end": [3110, JSON_UNITS_HPA],
    "p_diff": [0, JSON_UNITS_HPA],
    "p_drop_allowed": [30, JSON_UNITS_HPA],
    "p_rise_allowed": [5, JSON_UNITS_HPA],
    "runtime": [1800, JSON_UNITS_SEC],
    "runtime_target": [1800, JSON_UNITS_SEC]
  },
  "temperatures": {
    "temp_start": [21.12345678, JSON_UNITS_C],
    "temp_end": [21.87654321, JSON_UNITS_C]
  },
  "result": {
    "result": 3          // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK,
                        //          12:=Unstable Data, 14:=Pressure too low
  }
}

```

Druktest max (Serial: 150/xxxxx)

G-07 Inneninstallation (Menu ID: 55)

```

"results": {
  "phase0": {
    "meas_type": "Gas G4, G6",
    "medium": 1, // Values: 1:=Air, 2:=Gas, 4:=Water
    "p_test": [32.0, JSON_UNITS_HPA],
    "servicedate_measurement": "2020-07-18T10:26:32",
    "location_lat": 52.6,
    "location_long": 7.4
  },
  "pressure_rise": {
    "p_start": [0.0, JSON_UNITS_HPA],
    "p_end": [5.7, JSON_UNITS_HPA],
    "runtime": [97, JSON_UNITS_SEC],
    "t_phase_start": "2019-07-18T10:21:31",
    "t_phase_end": "2019-07-18T10:26:32"
  },
  "tightness": {
    "p_start": [100.0, JSON_UNITS_HPA],
    "p_end": [92.7, JSON_UNITS_HPA],
    "p_diff": [7.3, JSON_UNITS_HPA],
    "p_drop_allowed": [3.0, JSON_UNITS_HPA],
    "runtime": [300, JSON_UNITS_SEC],
    "t_phase_start": "2019-07-18T10:21:31",
    "t_phase_end": "2019-07-18T10:26:32"
  }
}

```

```

},
"result": {
  "result": 2,          // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK,
                        //          15:=Press.rise not OK
  "cnt_repetitions": 1
}
}

```

G-12 Netzanschlussleitung (Menu ID: 54)

```

"results": {
  "phase0": {
    "pipe_data": [{
      "dn": [32, JSON_UNITS_MM],
      "length": [72.80000305, JSON_UNITS_M],
      "sdr": 11,
      "volume": [0.03919411823, JSON_UNITS_L],
      "material": "PE 100 SDR 11"
    }, {
      "dn": [63, JSON_UNITS_MM],
      "length": [25.20000076, JSON_UNITS_M],
      "sdr": 11,
      "volume": [0.0525861308, JSON_UNITS_L],
      "material": "PE 100 SDR 11"
    }
  ],
  "is_pipe_new": true,
  "op": [30, JSON_UNITS_HPA],
  "volume_floor": [0, JSON_UNITS_L],
  "volume_ceil": [13.1, JSON_UNITS_L],
  "medium": 1,          // Values: 1:=Air, 2:=Gas, 4:=Water
  "servicedate_measurement": "2020-07-18T10:26:32",
  "location_lat": 52.6,
  "location_long": 7.4
},
"loadtest": {
  "p_start": [0, JSON_UNITS_HPA],
  "p_end": [0, JSON_UNITS_HPA],
  "p_diff": [0, JSON_UNITS_HPA],
  "p_drop_allowed": [3.0, JSON_UNITS_HPA],
  "runtime": [300, JSON_UNITS_SEC],
  "t_phase_start": "2019-07-18T10:21:31",
  "t_phase_end": "2019-07-18T10:26:32"
},
"tightness": {
  "p_start": [0, JSON_UNITS_HPA],
  "p_end": [0, JSON_UNITS_HPA],
  "p_diff": [0, JSON_UNITS_HPA],
  "p_drop_allowed": [100.0, JSON_UNITS_HPA],
  "p_rise_allowed": [100.0, JSON_UNITS_HPA],
  "runtime": [0, JSON_UNITS_SEC],
  "t_phase_start": "2019-07-18T10:21:31",
  "t_phase_end": "2019-07-18T10:26:32"
},
"result": {
  "result": 2          // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK
}
}

```

G-22 Festigkeit (Menu ID: 57)

```

"results": {
  "phase0": {
    "op": [30, JSON_UNITS_HPA],
    "medium": 1,        // Values: 1:=Air, 2:=Gas, 4:=Water
    "material": 1,     // Values: 1:=Metal, 2:=Plastic
    "servicedate_measurement": "2020-07-18T10:26:32",
    "location_lat": 52.6,
    "location_long": 7.4
  },
  "loadtest": {
    "p_start": [0.0, JSON_UNITS_HPA],
    "p_end": [0.0, JSON_UNITS_HPA],
    "p_diff": [0.0, JSON_UNITS_HPA],
    "p_drop_allowed": [10.0, JSON_UNITS_PERCENT],
    "runtime": [0, JSON_UNITS_SEC],
    "t_phase_start": "2019-07-18T10:21:31",
    "t_phase_end": "2019-07-18T10:26:32"
  },
}

```

```

"result": {
  "result": 2      // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK
}
}

```

Pressure test free (Menu ID: 53)

```

"results": {
  "phase0": {
    "location_lat": 52.6,
    "location_long": 7.4,
    "is_gauge_pressure": True
  },
  "stabilization": {
    "p_max": [691, JSON_UNITS_HPA],
    "runtime": [60, JSON_UNITS_SEC]
  },
  "measurement": {
    "p_start": [684, JSON_UNITS_HPA],
    "p_end": [682, JSON_UNITS_HPA],
    "p_diff": [2, JSON_UNITS_HPA],
    "p_min": [681, JSON_UNITS_HPA],
    "p_max": [684, JSON_UNITS_HPA],
    "p_avg": [682.7662354, JSON_UNITS_HPA],
    "runtime": [60, JSON_UNITS_SEC],
    "allowed_drop": [25, JSON_UNITS_HPA]
  },
  "result": {
    "result": 3      // Values: 1:=No evaluation, 2:=Cancelled, 3:=OK, 4:=Not OK
  }
}

```

JSON “mconfig” data

OLLI (Serial: 110/xxxxx), OLLI-FP (Serial: 111/xxxxx)

Confined space entry (Menu ID: 0), LEL (Menu ID: 35)

```

"mconfig": {
  "ch4": {
    "a11": [8800, JSON_UNITS_PPM],
    "a12": [17600, JSON_UNITS_PPM],
    "lel_factor_ch4": [440, JSON_UNITS_PPM_LEL]
  },
  "c3h8": {
    "a11": [3400, JSON_UNITS_PPM],
    "a12": [6800, JSON_UNITS_PPM],
    "lel_factor_c3h8": [170, JSON_UNITS_PPM_LEL]
  },
  "co2": {
    "a11": [5000, JSON_UNITS_PPM],
    "a12": [20000, JSON_UNITS_PPM],
  },
  "o2": {
    "a11": [190000, JSON_UNITS_PPM],
    "a12": [170000, JSON_UNITS_PPM],
    "a13": [230000, JSON_UNITS_PPM]
  },
  "co": {
    "a11": [30, JSON_UNITS_PPM],
    "a12": [60, JSON_UNITS_PPM]
  },
  "h2s": {
    "a11": [5, JSON_UNITS_PPM],
    "a12": [20, JSON_UNITS_PPM]
  }
}

```

Building inspection (Menu ID: 3), ppm-LEL-Vol.% (Menu ID: 37)

```

"mconfig": {
  "ch4": {
    "a11": [50, JSON_UNITS_PPM],
    "a12": [1000, JSON_UNITS_PPM],
    "lel_factor_ch4": [440, JSON_UNITS_PPM_LEL]
  },
}

```

```

"c3h8": {
  "al1": [50, JSON_UNITS_PPM],
  "al2": [1000, JSON_UNITS_PPM],
  "lel_factor_c3h8": [170, JSON_UNITS_PPM_LEL]
},
"co": {
  "al1": [10, JSON_UNITS_PPM]
}
}

```

Above ground inspection (Menu ID: 5), ppm (Menu ID: 38)

```

"mconfig": {
  "ch4": {
    "al1": [20, JSON_UNITS_PPM],
    "al2": [500, JSON_UNITS_PPM]
  },
  "c3h8": {
    "al1": [10, JSON_UNITS_PPM],
    "al2": [1000, JSON_UNITS_PPM]
  }
}

```

JSON "mstate" data

OLLI (Serial: 110/xxxxx), OLLI-FP (Serial: 111/xxxxx)

Confined space entry (Menu ID: 0), LEL (Menu ID: 35)

```

"mstate": {
  "values": {
    "ch4": [53.27442932, JSON_UNITS_PPM],
    "co2": [440.2344, JSON_UNITS_PPM],
    "o2": [209497.2344, JSON_UNITS_PPM],
    "co": [-0.5641149879, JSON_UNITS_PPM],
    "h2s": [0.00473280251, JSON_UNITS_PPM]
  },
  "min_max": {
    "ch4": [84.53130341, JSON_UNITS_PPM],
    "c3h8": [null, JSON_UNITS_PPM], // May be null, if gas not active
    "co2": [722, JSON_UNITS_PPM],
    "o2": [207762.25, JSON_UNITS_PPM], // O2 shows minimum instead of maximum
    "co": [-0.3575732112, JSON_UNITS_PPM],
    "h2s": [0.01693882048, JSON_UNITS_PPM]
  }
}

```

Building inspection (Menu ID: 3), ppm-LEL-Vol.% (Menu ID: 37)

```

"mstate": {
  "ch4": [1.595352173, JSON_UNITS_PPM],
  "co": [-0.5719232559, JSON_UNITS_PPM],
  "max_ch4": [17.27457809, JSON_UNITS_PPM], // May be null if maximum not shown
  "flow": [0.02, JSON_UNITS_L_H] // Flow only available if pump installed; may be null
}

```

Above ground inspection (Menu ID: 5), ppm (Menu ID: 38)

```

"mstate": {
  "ch4": [-1.499137878, JSON_UNITS_PPM],
  "max_ch4": null // Maximum only outputted if visible
}

```

Purging gas purity (Menu ID: 1)

```

"mstate": {
  "ch4": [565.5761719, JSON_UNITS_PPM],
  "o2": [208816.1094, JSON_UNITS_PPM],
  "max_ch4": null // Maximum only outputted if visible
}

```

Bar hole testing (Menu ID: 4), Vol.% (Menu ID: 36)

```

"mstate": {
  "ch4": [899.7128906, JSON_UNITS_PPM],
  "max_ch4": [1276.314453, JSON_UNITS_PPM],
  "o2": [208950.3281, JSON_UNITS_PPM],
}

```

```
"min_o2": [208940.2031, JSON_UNITS_PPM],
"co2": [440.1, JSON_UNITS_PPM]
}
```

Example code

Following pseudocode shows the process of reading measurements and menu information from an instrument.

```
# Choose "Bluetooth connection" from the menu of the instrument

# Search for MAC address of device 110/12345 and open connection
mac = bt_search_dev("110/12345")
handle = bt_connect_dev(mac)

# List stored measurements
response = bt_send_command(handle, "+jml\n")
mlist = json_decode(response)

# Load selected measurement (13.03.2019 14:14:01) from instrument
response = bt_send_command(handle, "+jmf=\"20190313/141401\"\n")
measurement = json_decode(response)
print(measurement)

# Enable automatic json mode for menus and start a supported menu

# Read device information
response = bt_send_command(handle, "+jdi\n")
dev_info = json_decode(response)

# Read menu configuration
response = bt_send_command(handle, "+jpc\n")
mconfig = json_decode(response)

# Read menu state
response = bt_send_command(handle, "+jps\n")
mstate = json_decode(response)
```

Units

```
JSON_UNITS_MBAR = 10,      /* mbar */
JSON_UNITS_BAR = 11,      /* bar */
JSON_UNITS_HPA = 12,     /* hPa */
JSON_UNITS_KPA = 13,     /* kPa */
JSON_UNITS_MPA = 14,     /* MPa */
JSON_UNITS_MWS = 15,     /* mWS */
JSON_UNITS_PSI = 16,     /* psi */
JSON_UNITS_AT = 17,      /* at */
JSON_UNITS_VOL = 50,     /* Vol% */
JSON_UNITS_UEG = 51,     /* %UEG */
JSON_UNITS_PPM = 52,     /* ppm */
JSON_UNITS_MGM3 = 53,    /* mg/m3 */
JSON_UNITS_LBS_MMCF = 54, /* lbs/MMCF */
JSON_UNITS_SEC = 100,    /* sec */
JSON_UNITS_L_H = 130,    /* l/h */
JSON_UNITS_RF = 131,     /* %rF */
JSON_UNITS_PERCENT = 132, /* Prozent */
JSON_UNITS_NAMGM3 = 133, /* nA/mg/m3 */
JSON_UNITS_L = 134,      /* Liter */
JSON_UNITS_C = 150,      /* Celsius */
JSON_UNITS_F = 151,      /* Fahrenheit */
JSON_UNITS_K = 152,      /* Kelvin */
JSON_UNITS_V = 180,      /* Volt */
JSON_UNITS_A = 181,      /* Ampere */
JSON_UNITS_OHM = 182,    /* Ohm */
JSON_UNITS_W = 183,      /* Watt */
JSON_UNITS_M = 184,      /* Meter */
JSON_UNITS_MM = 185,     /* Millimeter */
JSON_UNITS_NONE = 186,   /* Dimensionless quantity */
JSON_UNITS_PPM_LEL = 187, /* ppm/LEL */
```

Revision History

Version	Date	Editor	Changes
2.0	08.05.2019	MW	Initial Version
2.1	23.05.2019	MW	Added menus for "GasTest delta3"
2.2	18.07.2019	MW	<ul style="list-style-type: none"> - Changed G-07 key "p_drop" to "p_diff" to match firmware - Updated unit in G-12 "op" from 12 to JSON_UNITS_HPA for better readability - Added new fields to G-07, G-12 and G-22 - Added info about connection errors
2.3	03.09.2019	MW	<ul style="list-style-type: none"> - Added new fields to Regulator test and Regulator test external
2.4	25.09.2019	MW	<ul style="list-style-type: none"> - Added fields "location_lat" and "location_long" to G-07, G-12, G-22 - Added field "servicedate_measurement" to G-07, G-12, G-22 - Added smart memo as new device
2.5	12.02.2020	MW	<ul style="list-style-type: none"> - Added field "pipe_data" to G-12 - Added WEVG menus to GasTest delta3 and smart memo
2.6	09.03.2020	iGeb	<ul style="list-style-type: none"> - Added phase "pressure_rise" to G-07 - Added new value 15 at field "result" to G-07
2.7	03.06.2020	MW	<ul style="list-style-type: none"> - Added field "is_gauge_pressure" to Pressure test free - Added Pressure test free to Druktest max - Added info for external temperature sensor (smart memo) - Added W400 measurements to smart memo
2.8	18.09.2020	iGeb	<ul style="list-style-type: none"> - Added SIA 190 air and VSA air to smart memo - Added SVGW G2 measurements to smart memo - Added further W 400 / W 101 measurements to smart memo - Added LD PE, MD PE and MD ST to smart memo - Corrections in B3 supply line at smart memo
2.9	10.12.2020	MW	<ul style="list-style-type: none"> - Added new commands +jpc, +jps and +jdi - Added "mconfig" and "mstate" for OLLI - Improved document formatting