

ANNEX 5

TELEMETRY AND NEAR REAL TIME DATA INTERFACE

Representative/Author	Initials	Connected Party	Date	Signature

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1 General description

The aim of this Annex 5 (*Telemetry and near real time data interface*) is to describe the timing, format, and content of the telemetry and near real time fiscal metering data and the procedure of exchanging this data between Parties.

2 Definitions

Capitalized terms have the meaning given to them in the main text of this Agreement unless explicitly stated otherwise in this Annex 5.

“Counter Net Mass”:

Counter for the net mass flow of Gas, as measured by the mass flow meter. The net mass flow shall comprise hydrogen only, excluding any other components. Both the current and hourly counter values are required, including their timestamps.

“Counter Gross Mass”:

Counter for the gross mass flow of Gas, as measured by the mass flow meter. Both the current and hourly counter values are required, including their timestamps.

“Counter Energy”:

Counter for the net energy content of the Gas, expressed in kWh (net). Only the net energy content of hydrogen is considered. See Annex 6 (*Fiscal and non-fiscal Metering Manual*).

Both the current and hourly counter values are required, including their timestamps.

“Quality Data”:

All agreed quality measurements required for fiscal metering.

“Remote Terminal Unit” or “RTU”:

A field-installed control and data acquisition device that interfaces between local instrumentation and a central control system. Its primary function is to collect measurement and status data from field equipment, transmit such data to the central system, and receive and execute remote control commands.

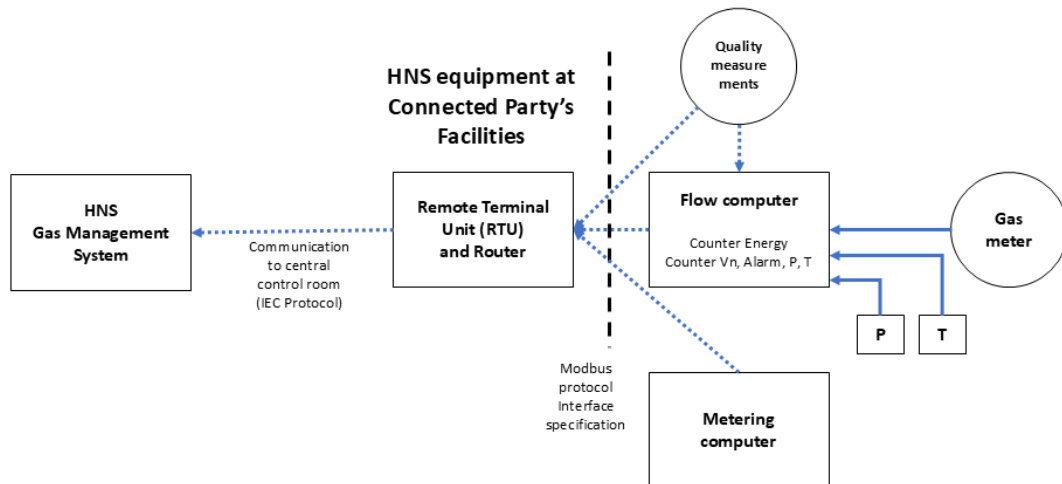
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3 Overview

A single RTU is located at Connected Party's site, and all signals specified in this Annex 5 are transmitted via that RTU.

The interface specifications described in this Annex 5 serve as input for the RTU and can be implemented via a (MODBUS) connection on the flow computer, as well as via connections to other measurements, such as quality measurements.



Scheme 3.1: Schematic overview (provided for illustrative purposes only).
[A specific representation at Connected Party Facilities may be included]

The router and RTU are equipment installed and maintained by HNS.

The interfaces for measurement data depend on the configuration of Connected Party's measurement system. These shall comprise a MODBUS connection with the flow computer/measurement computer or discrete signals, such as 24 mA.

The technical interface may comprise RS232/RS485, TCP/IP, MODBUS, MODBUS/IP.

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4 Requirements for Telemetry**4.1 Telemetry signals**

Connected Party shall make available to HNS, for on-line transfer via the HNS telemetry system at Connected Party's Facilities, all or a selection of the following signals from the Connection. [Connected Party's selection shall be included].

signals	unit
delivery pressure	bar (g)
delivery temperature	°C
gas flow	m ³ (S)/h
oxygen content	ppm
nitrogen content	ppm
dewpoint	°C
hydrogen content	mol%
plant state	down/starting up/running/shutting down
constituents in accordance with the quality specifications as published by the Competent Authority	[Depends on type of constituent]

4.2 General description

In the event of Non Compliant Gas, the measured value may exceed the measuring range of the measurement device. In such circumstances, two measurement devices shall be installed to cover both the compliant and the anticipated non-compliant measurement ranges.

Procedures concerning the unavailability of the signals are included in Annex 7 (*Dispatching Procedure*).

Connected Party shall make available the signals for the on-line transfer to HNS via the MODBUS protocol.

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5 Requirements for near real time data interface

5.1 Requirements for mass and energy-data

All data shall be available for each measurement run, gas meter and, where applicable, flow direction. For example, where Connected Party has two (2) runs, two (2) sets of data shall be provided. Where Connected Party has both a main and a backup measurement, two (2) sets of data shall likewise be provided, one (1) for the main and one (1) for the backup measurement.

All data shall be available within one (1) minute following the end of each five (5)-minute interval. Data may also be updated at more frequent intervals. All data shall include the date and time of measurement. A scan time of ten (10) seconds shall be applied.

The data shall include five (5)-minute and hourly counters, including timestamps and alarms.

Data element	Code	Description	Unit
5-minute values			
Counter Energy	C_E_5	The counter energy 5-minute value	kWh
Counter Net Mass	C_MN_5	Counter for the net mass flow of Gas, as measured by the mass flow meter (hydrogen only) 5-minute value	kg
Counter Gross Mass	C_MG_5	Counter for the gross mass flow of Gas, as measured by the mass flow meter 5-minute value	kg
Calorific Value	HS_5	Calorific Value 5-minute value	kWh/kg
Accountable alarm	Acc_alm	Current Accountable alarm when one or more measurements are invalid	
DateTime	YYYY-MM-DDTHH:mm:ss	Date and time when the data is updated, 5-minute value	UTC+1
Hourly values			
Counter Energy <i>last hour</i>	C_E_H	The counter energy at the last whole hour	kWh
Counter Nett Mass <i>last hour</i>	C_MN_H	Counter for the net mass flow of Gas, as measured by the mass flow meter (hydrogen only) at the last whole hour	kg
Counter Gross Mass <i>last hour</i>	C_MG_H	Counter for the gross mass flow of Gas, as measured by the mass flow meter at the last whole hour	kg
Calorific value <i>last hour</i>	HS_H	Calorific value at the last whole hour	kWh/kg
DateTime <i>last hour</i>	YYYY-MM-DDTHH:mm:ss	Date and time at the last whole hour	UTC+1

If one or more counters are deemed unreliable or invalid, the accountable alarm shall be set.

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5.2 Requirements for Quality Data

Quality measurements required for accountable calculations depends on the production method and setup of the installation of Connected Party. Where such quality measurements are necessary for accountable purposes, this requirement is specified in this Article.

For example:

Each 15 minutes, a set of Quality Data will be made available at the RTU. The quality information includes a code provided by HNS (identification).

5.3 Additional requirements

- (a) HNS will install a dedicated communication data line at the telecommunication entry point at an agreed location of Connected Party;
- (b) An HNS-owned router and RTU shall be installed by HNS at Connected Party's Facilities;
- (c) Connected Party shall provide HNS, for the installation and maintenance of the communication line on behalf of the data:
 - 1) a drawing of the building with the position of the telecommunication entry point;
 - 2) a connection between router and telecommunication entry point;
 - 3) space and power for equipment (router) of HNS.
- (d) Failures in the (metering) system to the (MODBUS) interface will be solved by Connected Party. See schematic overview;
- (e) Failures in the router, communication data line and RTU will be solved by HNS. See schematic overview;
- (f) Failures will be solved by each party as soon as possible with a maximum repair time of 24 Hours;
- (g) Failures will be communicated between the dispatching centres (contact information is provided in Annex 7 (*Dispatching Procedure*));
- (h) Connected Party shall provide HNS information regarding maintenance and changes to the metering system and run configuration. This information shall be available at HNS the latest on Wednesday before the week the maintenance and/or change will be implemented.

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6 Modbus registers

The aforementioned requirements give rise to a set of MODBUS registers connected to the RTU. The MODBUS register list comprises the data specified in Article 4 (*Requirements for Telemetry*), namely registers 40001 through 40999.

An example of a MODBUS register is illustrated below.

Modbus list						
The following ranges of register numbers are used:						
Overall MODBUS range	40000-49999					
Range for operational info	40000-40999					
Ranges for measurement info	41000-49999					
Volume Conversion Device (VCD)	4VR00-4VR99	V = 1 (main flow computer) or 2 (backup flow computer)				
Run number	4VR00-4VR99	R = 1, 2 or 3				
Start Register	Name	Type	Unit	Description	Timestamp Register	
40001	Pressure_C	Float32	bar (g)	Delivery pressure (current value)		
40003	Temp_C	Float32	°C	Delivery temperature (current value)		
40005	Qn_C	Float32	Sm ³ /h	Normalized flow (current value)		
40007	O2_C	Float32	ppm	Oxygen content (current value)		
40009	N2_C	Float32	ppm	Nitrogen content (current value)		
40011	H2O_C	Float32	°C	Dewpoint (current value)		
40013	H2_C	Float32	mol %	Hydrogen content (current value)		
40015	PlantStatus_C	Int		Operational status (current value)		0=Idle, 1=Running, 2=Starting-up, 3=Shutting-down
Configuration of First EVHI, 3 Runs						
41001	EvhiRunTime_C@	DateTime		Run time EVHI (current value) main		Main/Backup - Run number - Direction
41005	EvhiRunTime_5@	DateTime		Run time EVHI (5 min value) main		EVHI 1 (Main)
41009	EvhiRunTime_H@	DateTime		Run time EVHI (hourly value) main		EVHI 1 (Main)
41101	CE_5	Float64	kWh	Counter - Totalized nett energy (5 min value) main Run 1 Entry	41005	EVHI 1 (Main) Run 1 Forward flow
41105	CE_H	Float64	kWh	Counter - Totalized nett energy (hourly value)	41009	EVHI 1 (Main) Run 1 Forward flow
41109	CMN_5	Float64	kg	Counter - Totalized nett mass (5 min value)	41005	EVHI 1 (Main) Run 1 Forward flow
41113	CMN_H	Float64	kg	Counter - Totalized nett mass (hourly value)	41009	EVHI 1 (Main) Run 1 Forward flow
41117	CMG_5	Float64	kg	Counter - Totalized gross mass volume (5 min value)	41005	EVHI 1 (Main) Run 1 Forward flow
41121	CMG_H	Float64	kg	Counter - Totalized gross mass volume (hourly value)	41009	EVHI 1 (Main) Run 1 Forward flow
41125	HS_5	Float32	kWh/kg	Superior calorific value (5 min value)	41005	EVHI 1 (Main) Run 1 Forward flow
41127	HS_H	Float32	kWh/kg	Superior calorific value (hourly value)	41009	EVHI 1 (Main) Run 1 Forward flow
41129	RAW1_C	Int		See sheet RAW1 (current value)		EVHI 1 (Main) Run 1 Forward flow
41201	CE_5	Float64	kWh	Counter - Totalized nett energy (5 min value) main Run 1 Entry	41005	EVHI 1 (Main) Run 2 Forward flow
41205	CE_H	Float64	kWh	Counter - Totalized nett energy (hourly value)	41009	EVHI 1 (Main) Run 2 Forward flow
41209	CMN_5	Float64	kg	Counter - Totalized nett mass (5 min value)	41005	EVHI 1 (Main) Run 2 Forward flow
41213	CMN_H	Float64	kg	Counter - Totalized nett mass (hourly value)	41009	EVHI 1 (Main) Run 2 Forward flow
41217	CMG_5	Float64	kg	Counter - Totalized gross mass volume (5 min value)	41005	EVHI 1 (Main) Run 2 Forward flow
41221	CMG_H	Float64	kg	Counter - Totalized gross mass volume (hourly value)	41009	EVHI 1 (Main) Run 2 Forward flow
41225	HS_5	Float32	kWh/kg	Superior calorific value (5 min value)	41005	EVHI 1 (Main) Run 2 Forward flow
41227	HS_H	Float32	kWh/kg	Superior calorific value (hourly value)	41009	EVHI 1 (Main) Run 2 Forward flow
41229	RAW1_C	Int		See sheet RAW1 (current value)		EVHI 1 (Main) Run 2 Forward flow
41301	CE_5	Float64	kWh	Counter - Totalized nett energy (5 min value) main Run 1 Entry	41005	EVHI 1 (Main) Run 3 Forward flow
41305	CE_H	Float64	kWh	Counter - Totalized nett energy (hourly value)	41009	EVHI 1 (Main) Run 3 Forward flow
41309	CMN_5	Float64	kg	Counter - Totalized nett mass (5 min value)	41005	EVHI 1 (Main) Run 3 Forward flow
41313	CMN_H	Float64	kg	Counter - Totalized nett mass (hourly value)	41009	EVHI 1 (Main) Run 3 Forward flow
41317	CMG_5	Float64	kg	Counter - Totalized gross mass volume (5 min value)	41005	EVHI 1 (Main) Run 3 Forward flow
41321	CMG_H	Float64	kg	Counter - Totalized gross mass volume (hourly value)	41009	EVHI 1 (Main) Run 3 Forward flow
41325	HS_5	Float32	kWh/kg	Superior calorific value (5 min value)	41005	EVHI 1 (Main) Run 3 Forward flow
41327	HS_H	Float32	kWh/kg	Superior calorific value (hourly value)	41009	EVHI 1 (Main) Run 3 Forward flow
41329	RAW1_C	Int		See sheet RAW1 (current value)		EVHI 1 (Main) Run 3 Forward flow
Configuration of Second EVHI, 3 Runs						
42001	EvhiRunTime_C@	DateTime		Run time EVHI (current value) main		EVHI 2 (Backup)
42005	EvhiRunTime_5@	DateTime		Run time EVHI (5 min value) main		EVHI 2 (Backup)
42009	EvhiRunTime_H@	DateTime		Run time EVHI (hourly value) main		EVHI 2 (Backup)
42101	CE_5	Float64	kWh	Counter - Totalized nett energy (5 min value) main Run 1 Entry	42005	EVHI 2 (Backup) Run 1 Forward flow
42105	CE_H	Float64	kWh	Counter - Totalized nett energy (hourly value)	42009	EVHI 2 (Backup) Run 1 Forward flow
42109	CMN_5	Float64	kg	Counter - Totalized nett mass (5 min value)	42005	EVHI 2 (Backup) Run 1 Forward flow
42113	CMN_H	Float64	kg	Counter - Totalized nett mass (hourly value)	42009	EVHI 2 (Backup) Run 1 Forward flow
42117	CMG_5	Float64	kg	Counter - Totalized gross mass volume (5 min value)	42005	EVHI 2 (Backup) Run 1 Forward flow
42121	CMG_H	Float64	kg	Counter - Totalized gross mass volume (hourly value)	42009	EVHI 2 (Backup) Run 1 Forward flow
42125	HS_5	Float32	kWh/kg	Superior calorific value (5 min value)	42005	EVHI 2 (Backup) Run 1 Forward flow
42127	HS_H	Float32	kWh/kg	Superior calorific value (hourly value)	42009	EVHI 2 (Backup) Run 1 Forward flow
42129	RAW1_C	Int		See sheet RAW1 (current value)		EVHI 2 (Backup) Run 1 Forward flow
42201	CE_5	Float64	kWh	Counter - Totalized nett energy (5 min value) main Run 1 Entry	42005	EVHI 2 (Backup) Run 2 Forward flow
42205	CE_H	Float64	kWh	Counter - Totalized nett energy (hourly value)	42009	EVHI 2 (Backup) Run 2 Forward flow
42209	CMN_5	Float64	kg	Counter - Totalized nett mass (5 min value)	42005	EVHI 2 (Backup) Run 2 Forward flow
42213	CMN_H	Float64	kg	Counter - Totalized nett mass (hourly value)	42009	EVHI 2 (Backup) Run 2 Forward flow
42217	CMG_5	Float64	kg	Counter - Totalized gross mass volume (5 min value)	42005	EVHI 2 (Backup) Run 2 Forward flow
42221	CMG_H	Float64	kg	Counter - Totalized gross mass volume (hourly value)	42009	EVHI 2 (Backup) Run 2 Forward flow
42225	HS_5	Float32	kWh/kg	Superior calorific value (5 min value)	42005	EVHI 2 (Backup) Run 2 Forward flow
42227	HS_H	Float32	kWh/kg	Superior calorific value (hourly value)	42009	EVHI 2 (Backup) Run 2 Forward flow
42229	RAW1_C	Int		See sheet RAW1 (current value)		EVHI 2 (Backup) Run 2 Forward flow
42301	CE_5	Float64	kWh	Counter - Totalized nett energy (5 min value) main Run 1 Entry	42005	EVHI 2 (Backup) Run 3 Forward flow
42305	CE_H	Float64	kWh	Counter - Totalized nett energy (hourly value)	42009	EVHI 2 (Backup) Run 3 Forward flow
42309	CMN_5	Float64	kg	Counter - Totalized nett mass (5 min value)	42005	EVHI 2 (Backup) Run 3 Forward flow
42313	CMN_H	Float64	kg	Counter - Totalized nett mass (hourly value)	42009	EVHI 2 (Backup) Run 3 Forward flow
42317	CMG_5	Float64	kg	Counter - Totalized gross mass volume (5 min value)	42005	EVHI 2 (Backup) Run 3 Forward flow
42321	CMG_H	Float64	kg	Counter - Totalized gross mass volume (hourly value)	42009	EVHI 2 (Backup) Run 3 Forward flow
42325	HS_5	Float32	kWh/kg	Superior calorific value (5 min value)	42005	EVHI 2 (Backup) Run 3 Forward flow
42327	HS_H	Float32	kWh/kg	Superior calorific value (hourly value)	42009	EVHI 2 (Backup) Run 3 Forward flow
42329	RAW1_C	Int		See sheet RAW1 (current value)		EVHI 2 (Backup) Run 3 Forward flow

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RAW1 Specification			
Bit	Name	Type	Description
0	AccAlarm	Boolean	Accountable Alarm
1			
2			
3			
4			
5			
6			
7			