

# FC-42 Evaluation Package

Laboratory Fuel Cell System

The FC-42 Evaluation Package is a modular system periphery that allows to run and evaluate the 360 W and 720 W versions of the industrially produced FC-42/HLC fuel cell stacks from Schunk.

Far less expensive than a fully equipped fuel cell test rig, the system offers all necessary parameters for initial investigation and serves as a platform to start product developments.



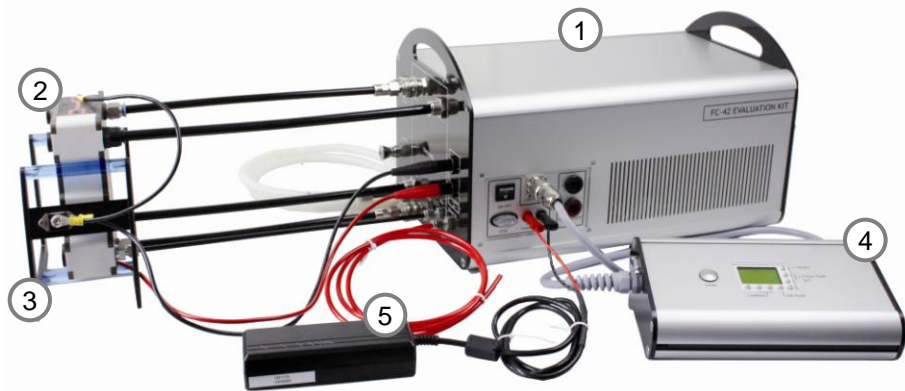
# System Overview

## FC-42 Evaluation Package

The FC-42 Evaluation Package is a modular system periphery for easy and safe operation of the FC-42/HLC series fuel cell stacks manufactured by Schunk.

The system is available in two versions, for 360 W and 720 W stacks. Instead of starting from scratch, developers can start their work on the basis of a running system, thus saving valuable time.

The system allows to analyze the operating behavior of FC-42/HLC stacks in normal operation. With its compact dimensions, the system is also suitable for the design of application-oriented prototypes.



1. Operator
2. FC-42/HLC fuel cell stack
3. Stack holder
4. Controller
5. Power Supply Unit

# System Overview

## FC-42/HLC Stack

The FC-42/HLC fuel cell stack series from Schunk is optimized for industrial production. Standardized 360 W module stacks of 360 and 720 W output are available.

Innovative materials and a special production technology are suitable for large-scale production, but also allow cost advantages even for small series.

Liquid cooling of the FC-42/HLC stacks enables flexibility in designing the cooling system and easy extraction of available heat. The innovative cooling jacket makes it possible to use conventional coolants (water/ glycol) and low-cost system parts.

With a maximum permissible operating temperature of 70 °C, the stacks can also be operated at higher ambient temperatures.



1. Air inlet
2. Coolant outlet
3. Hydrogen inlet
4. Hydrogen outlet
5. Coolant inlet
6. Air outlet

# Components

## FC-42 Evaluation Package



### Operator

The main function of the operator is to supply the stack with hydrogen, oxygen and to regulate the cooling. The operator's utility interface is arranged just like the interface on the stack. The operator contains the main switch, the data interface to the controller, input for external power supply and a power output to connect loads.

### Controller

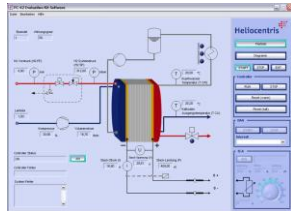
The controller depicts the major system parameters on an LCD display. Coolant temperature and excess air can be varied. An additional load button allows for isolating or disconnecting a load. An integrated data interface facilitates controlling the system via PC using the monitoring and control software.

### Stack holder and FC-42/HLC stack

The stack holder holds the FC-42 stack upright and protects it from reverse current with diodes integrated into its cooling plate. The FC-42 Evaluation Package is available with a 360 W or a 720 W stack, which is already included in the package.

# Components

## FC-42 Evaluation Package



### Software

The software is used for communication between the system control and a computer. The software allows for monitoring of all relevant operating parameters, e. g. stack voltage, stack current, coolant temperature and load state. All data can be saved for further editing.

### Power supply unit

The power supply unit provides mains power to the operator ensuring that the FC-42/HLC stack can be analyzed excluding own consumption resulting from powering the system periphery.

All items on this and previous page: Item No. 1902 (360 W), 1903 (720 W)

# Accessories

FC-42 Evaluation Package



## FC-42 fuel cell stack

360 W or 720 W FC-42 fuel cell stack for replacement only.

Item No. 1201, 1202



## Electronic load

The Electronic Load enables the controllable loading of the FC-42 Evaluation Package and features the operating modes: constant current, constant power and constant resistance. Load settings can be made manually or via software.

Item No. 1601



## Hydrogen detector

A hydrogen sensor for monitoring the workplace and testing for leaks, in addition to a special leak test liquid ensure maximum safety during use of the system.

Item No. 731

# Hydrogen Supply



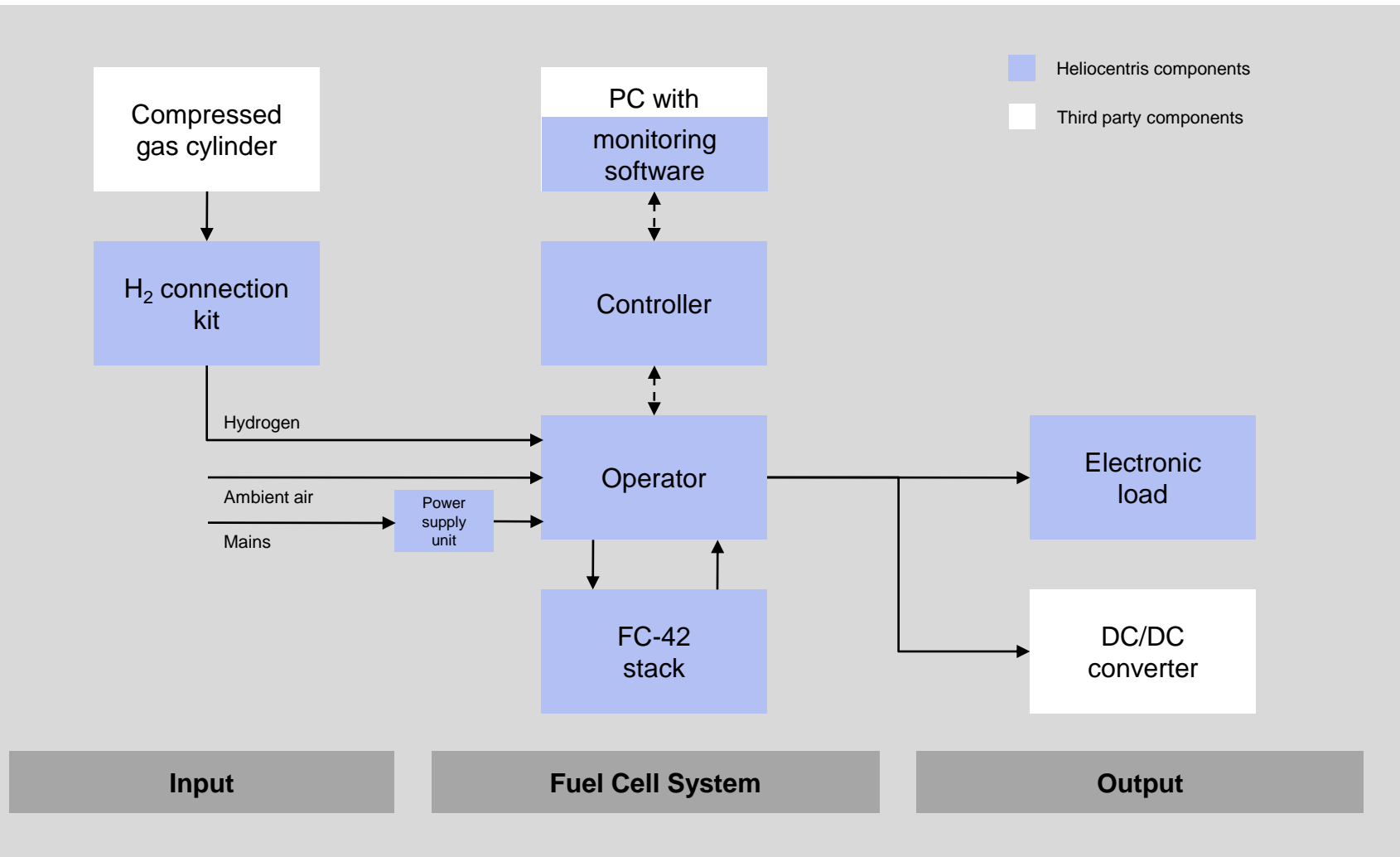
## H<sub>2</sub> connection kit

Compressed hydrogen cylinders can be connected easily and safely to the FC-42 Evaluation Package with the H<sub>2</sub> connection kit. A pressure reducer ensures that the system's maximum inlet pressure is not exceeded. Available with DIN, BS and CGA cylinder connection.

Item No. 631

# System Scheme

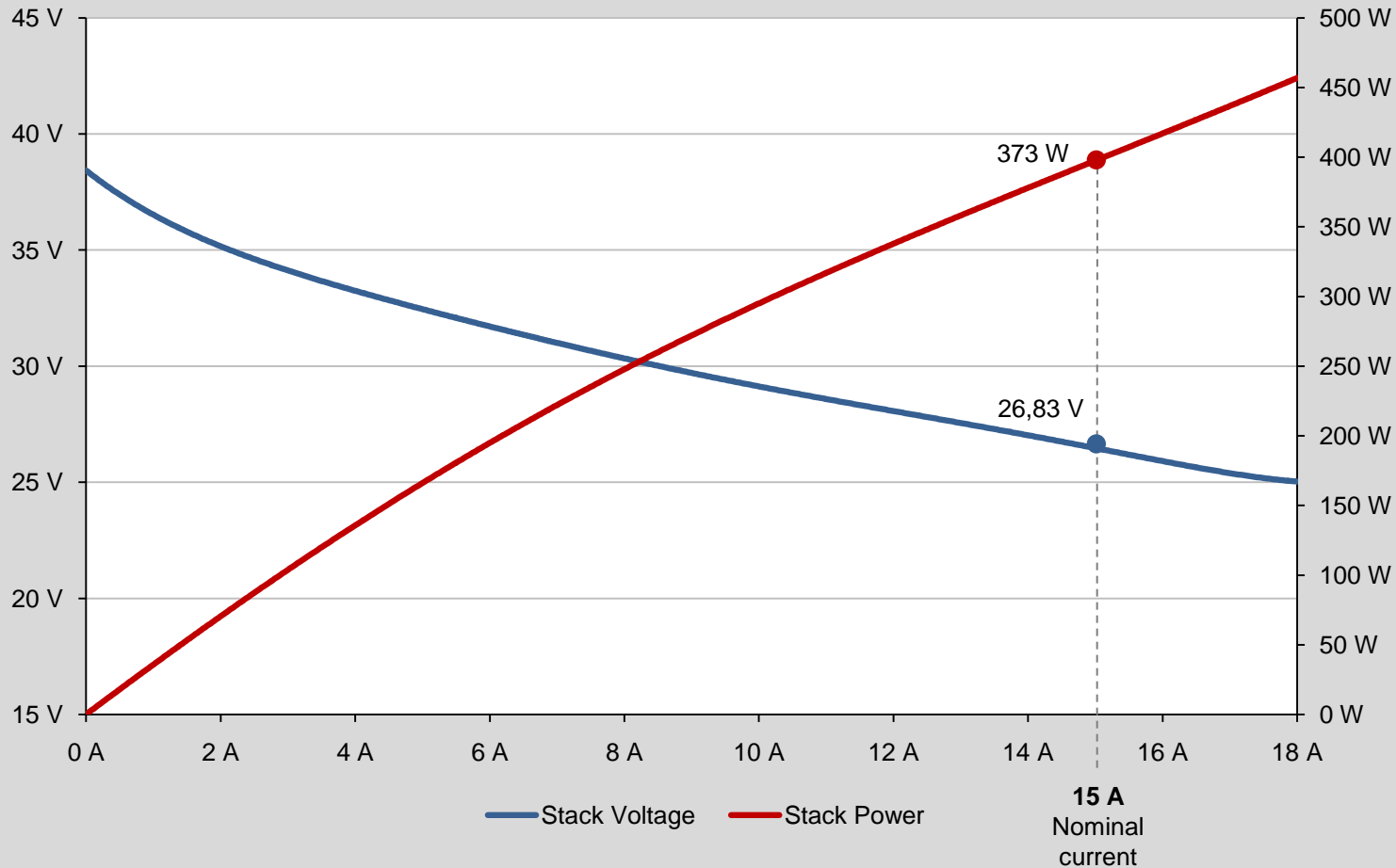
FC-42 Evaluation Package



# Power Curve

FC-42/HLC Stack from Schunk – 360 W

Data measured with the FC-42 Evaluation Package

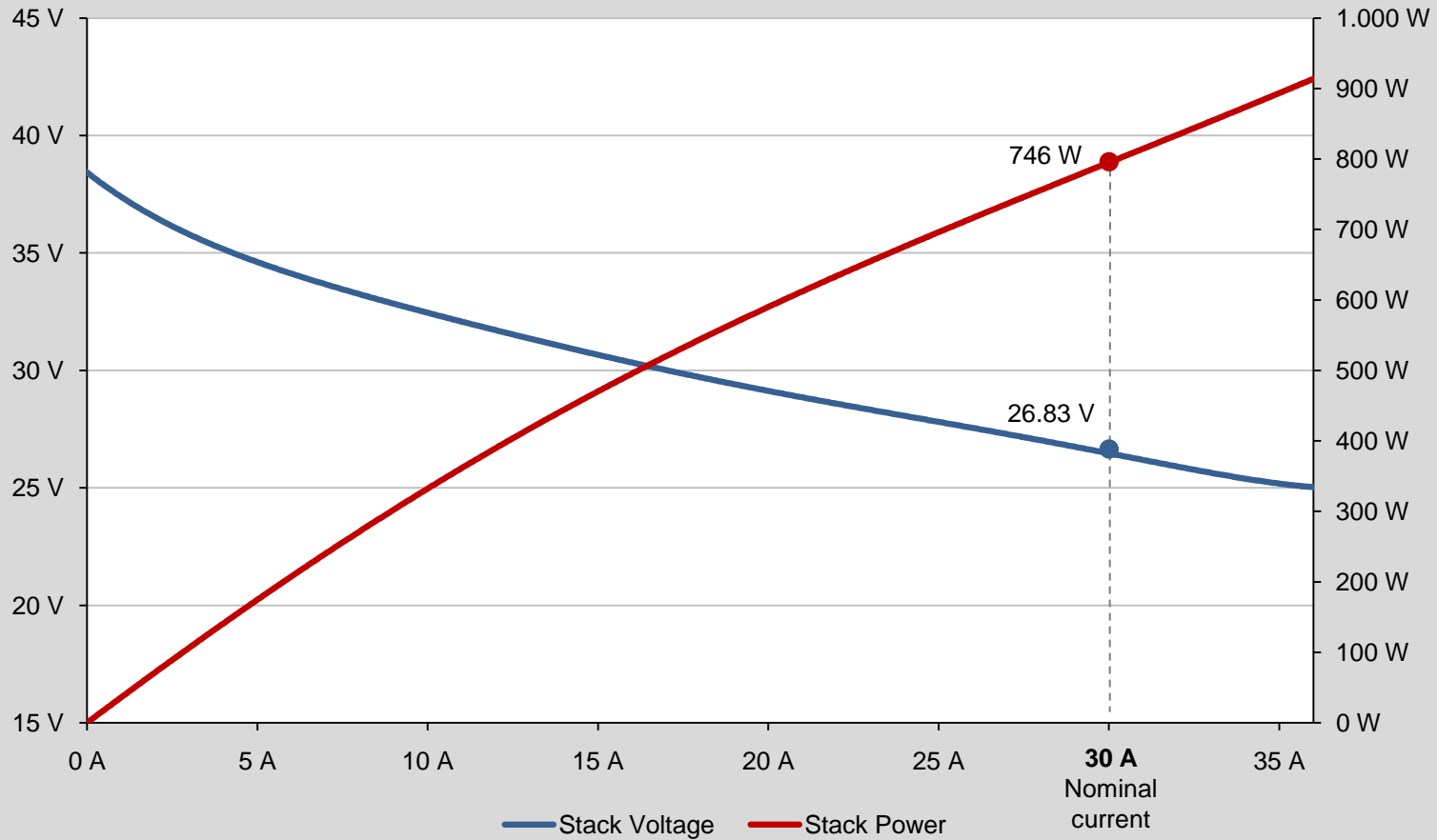




# Power Curve

FC-42/HLC Stack from Schunk – 720 W

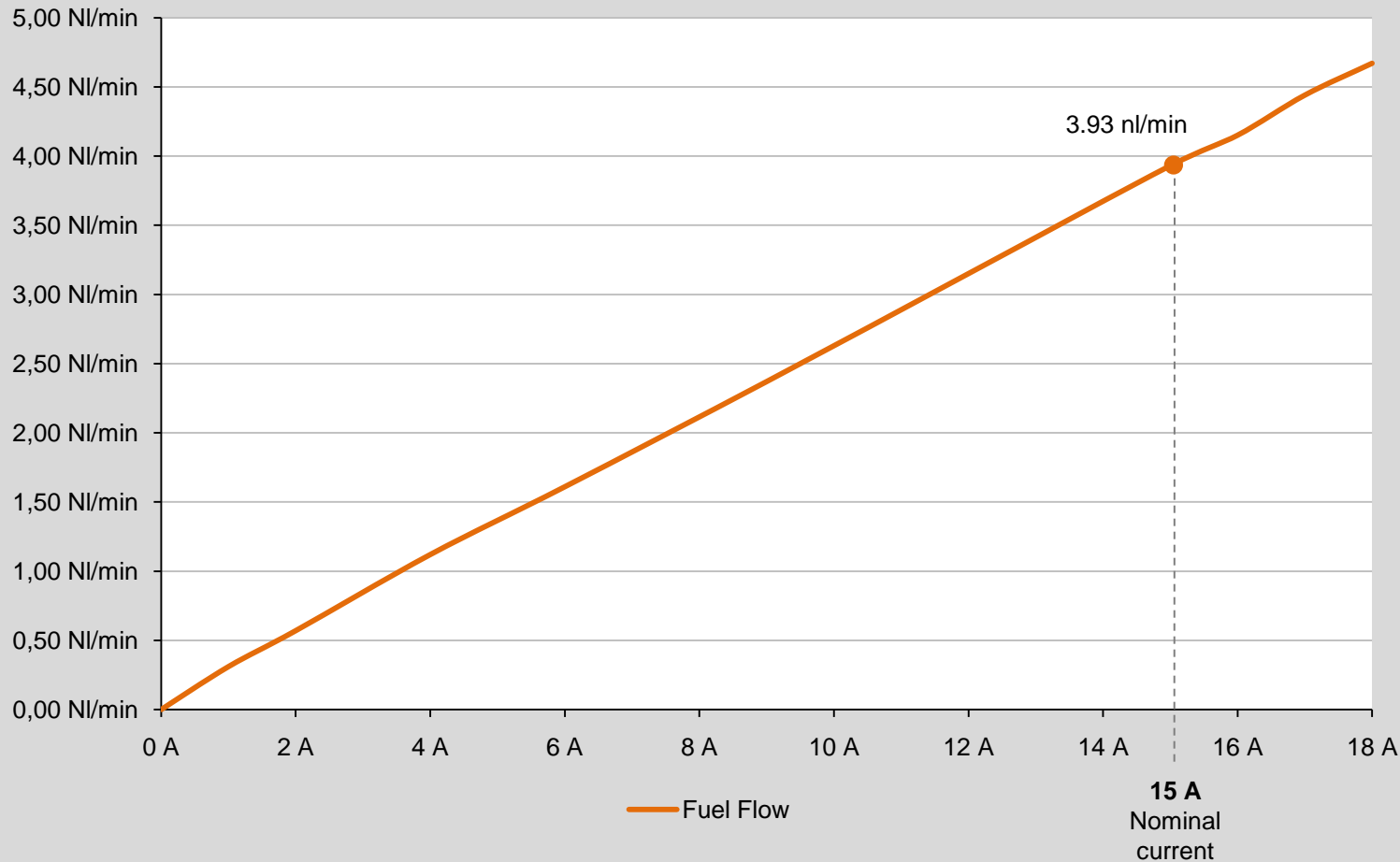
Data measured with the FC-42 Evaluation Package



# Hydrogen Consumption

FC-42/HLC Stack from Schunk – 360 W

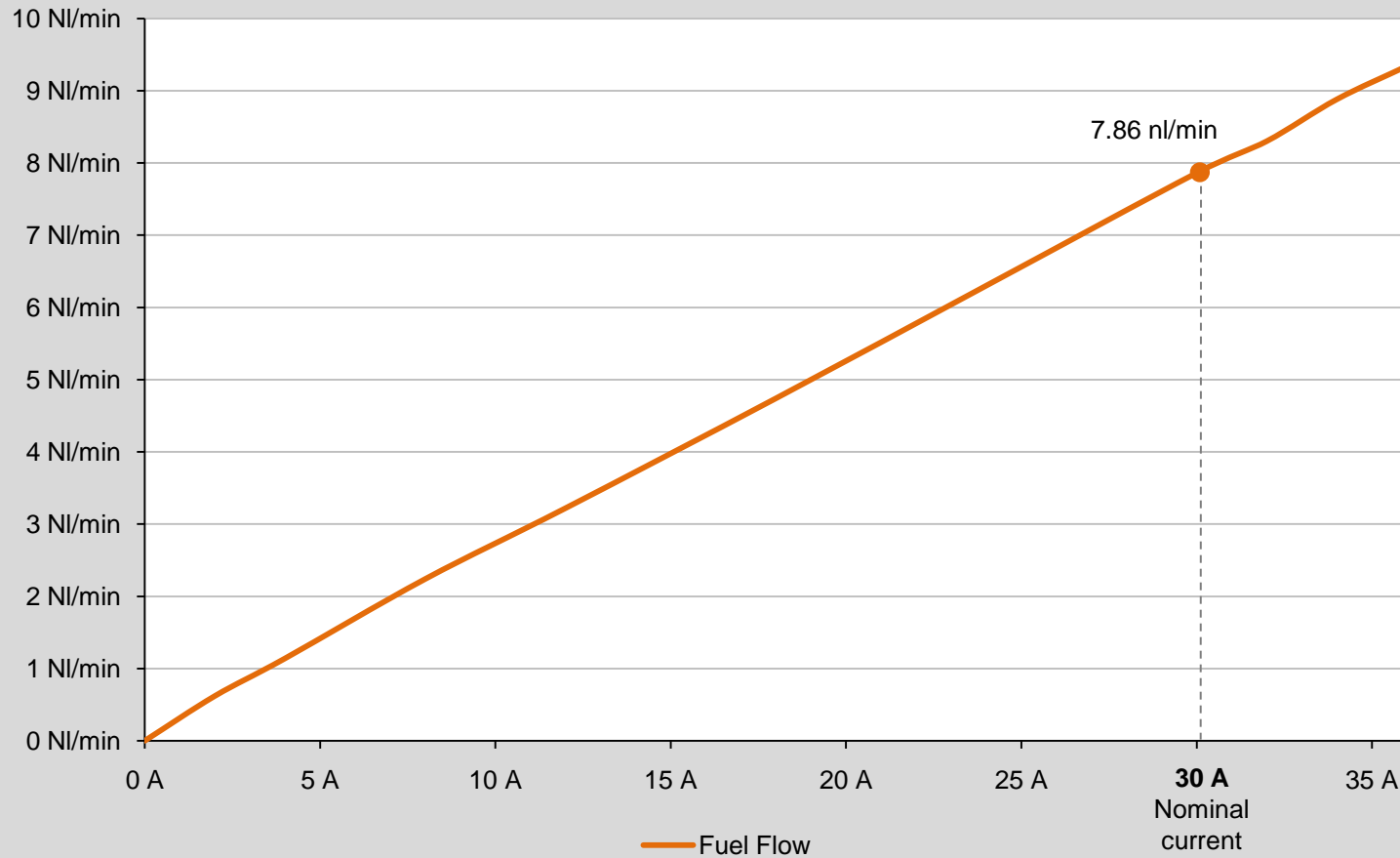
Data measured with the FC-42 Evaluation Package



# Hydrogen Consumption

FC-42/HLC Stack from Schunk – 720 W

Data measured with the FC-42 Evaluation Package



# Parts list

## FC-42 Evaluation Package

Item No.	Name	Description
<b>Product Packages</b>		
1902	360 W Version: FC-42 Evaluation Package	Product package including operator, controller, 360 W FC-42 stack, power supply unit, monitoring software, connection cables
1903	720 W Version: FC-42 Evaluation Package	Product package including operator, controller, 720 W FC-42 stack, power supply unit, monitoring software, connection cables
<b>Accessories</b>		
1201	FC-42 Fuel Cell Stack 720 W	Additional fuel cell stack (for replacement only)
1202	FC-42 Fuel Cell Stack 720 W	Additional fuel cell stack (for replacement only)
1601	Electronic Load	Electronic load module for controllable loading of the FC-42 Evaluation Package. Operating modes: constant current, constant power, constant resistance
731	Hydrogen Detector	Hydrogen leak detection set including a hydrogen sensor with a display and various acoustic and visual alarm levels as well as leak test liquid
<b>Hydrogen Supply Options</b>		
631	H2 Connection Kit	Connection kit for connecting compressed gas cylinders to quick coupling of FC-42 Evaluation Package's operator

# Technical Data

## FC-42/HLC Stack from Schunk

FC-42/HLC (Single stack)	
General	
Type	PEM fuel cell stack, 42 cells
Cooling	Water / glycol
Reactants	Hydrogen / air
Design	Closed cathode
Electrical	
Nominal output	360 W
Nominal voltage	24 V
Nominal current	15 A
Minimum voltage	15 V
Maximum voltage (open circuit)	42 V
Maximum current	30 A
Thermal	
Operating temperature	5 to 55 °C (self humidified) < 75 °C (external humidified)
Ambient temperature	5 to 70 °C
Storage temperature	-10 to 50 °C (dry unit)

Dimensions	
Width x depth x height	Ca. 130 x 61 x 190 mm
Weight	Ca. 2,000 g
Utilities	
Hydrogen quality	99.99 % (no traces of CO)
Hydrogen consumption	Ca. 3.93 sl/min at nominal load
Maximum anode pressure drop	15 mbar
Air	ca. 25 l/min at nominal load
Maximum cathode pressure drop	35 mbar
Coolant (water/glycol)	Ca. 3.1 l/min at nominal load
Maximum water pressure drop	150 mbar

The power delivered by the fuel cell depends on various parameters and decreases throughout the product life. All technical data correspond to the stack power at time of delivery.

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# Technical Data

## FC-42 Evaluation Package

FC-42 Evaluation Package	
General	
Operating location	Indoor, labs, dry
Ambient temperature	10 ... 30 °C
Relative humidity	20 ... 80 % (non-condensing)
Electrical	
Starting time	2 min, cold start to rated output
Operating voltage	20 ... 45 V
Rated voltage	24 V
Rated output	360 W / 720 W

Utilities	
Hydrogen quality	Min. 99.99 % (4.0) Recom. 99.999 % (5.0)
Hydrogen pressure	1 ... 11 bar
Hydrogen consumption	360 W version: 0 ... 4 l / min 720 W version: 0 ... 8 l / min
Cooling medium	Tap water
Coolant pressure	320 mbar
Coolant flow rate	240 l / h
Oxygen concentration	20 ... 30 Vol-% in ambient air
Air pressure	Max. 400 mbar
Air flow rate	65 l / min

The power delivered by the fuel cell depends on various parameters and decreases throughout the product life. All technical data correspond to the stack power at time of delivery.

The system works with hydrogen, a highly inflammable gas. Therefore, the respective local norms and safety regulations for transport, storage and operation have to be observed. Before setting up and operating the system, carefully read the instruction manual.

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