Table of contents

Combined encoders

.Combined encoders

.General information

Combined encoders have performed well in controlling synchronous motors. Combined encoders combine analog signals free of delay, that can only be evaluated in relative form, with absolute, digital-serial position detection.

Combining a digital-serial encoder (see ↘ "Digital encoders ") with an analog encoder (see ↘ "Analog encoders ") is a cost-efficient solution for position encoders (e.g., HIPERFACE®) for synchronous motor control that uses standardized components. In this case, the absolute value is used for absolute position initialization and thus also for the commutation angle, the position is cyclically generated from the analog signals (e.g., encoder with sine signals, 1 Vpp).

.Absolute position measurement

Combined encoders provide a range of absolute position detection:

- One revolution in the case of single-turn encoders
- An encoder-specific number of revolutions in the case of multi-turn encoders
- The absolute encoder range that can be digitally displayed in the case of linear encoders

.Encoders with HIPERFACE® interface

.Application-related information for project planning

Encoders with digital interfaces (RS485) for transmission of position, encoder and OEM data besides analog sine signals are referred to as HIPERFACE® encoders.

."EC" option required!

Analog signals as well as the digital interface can be evaluated via the multi-encoder input of the ctrlX DRIVE controllers (interface option EC).

.Absolute evaluation

Encoders with HIPERFACE® interface can be evaluated in absolute form if the travel range of an axis is within the actual position range that can be displayed in absolute form, i.e. the absolute encoder range. The absolute encoder range (S-0-0601.x.23) describes one encoder revolution for single-turn encoders, 4096 encoder revolutions for multi-turn encoders. For linear encoders, it is encoder type-specific.

.Supported encoder types

In terms of their encoder data memory content, two variants of HIPERFACE® encoder types are available:

- Encoder types with memory containing all data required for encoder evaluation ("electronic type plate").

- Encoder types with memory containing only the encoder type designation without any additional data,

The drive firmware handles the two configuration levels of the HIPERFACE® encoders as follows:

- Encoder types according to 1.) are recognized by the firmware according to the manufacturer type identifier "0xFF". Type-specific data are read from the memory (electronic type plate) and all encoder types can also be used according to 1.) without extension of the firmware.
- For encoder types according to 2.), all data required for encoder configuration according to the type are stored in a database in the drive firmware. Only HIPERFACE® encoders with data stored there are supported. If additional encoder types are to be supported according to 2.), the firmware has to be extended accordingly.

Type-specific settings	TTK70
Type ID (command 52h)	FFh
Free EEPROM [bytes]	1,792
Address	40h
Mode_485	E4h
Codes 0 ... 3	55h
Counter	0

Compatible Hiperfacegeber-Type-Id	
02h (e.g. SCS60/70)	**82h** (e.g. Lincoder 5mm /40m)
07h (e.g. SCM 60/70)	**90h** (e.g. Lincoder 1mm / 40m)
12h (e.g. SNS 50/60)	**91h** (e.g. Lincoder 2 mm / 40m)
22h (SCS-Kit 101)	**92h** (e.g. Lincoder 4 mm / 40m)
27h (SCM-Kit 101)	**93h** (e.g. Lincoder 8 mm / 80m)
32h (e.g. BRC-Singleturn)	**94h** (e.g. Lincoder 16 mm / 160m)
37h (e.g. BRC-Multiturn)	**FFh** (e.g. TTK 70, etc.)
42h (e.g. SEK52 Singleturn)	
47h (e.g. SEK52 Multiturn)	

Fig. 193: Type identifiers of HIPERFACE® encoder types supported by the firmware

> In general, only HIPERFACE® encoders with the address "40h" are supported!

.Commissioning

Encoders with a HIPERFACE® interface have to be connected at the optional slot XG21 (EC). They are automatically detected when the drive controller is switched on. When switching from CM to PM, the data of the motor and of the encoder are automatically loaded from the encoder memory to the controller.

> This is a "Plug & Play" encoder type which is configured automatically via the "encoder scan" function!
>
> If it is required to reduce the initialization period, deactivate the "encoder scan" function in "S-0-0602.x.1, Phys. encoder type". See also .

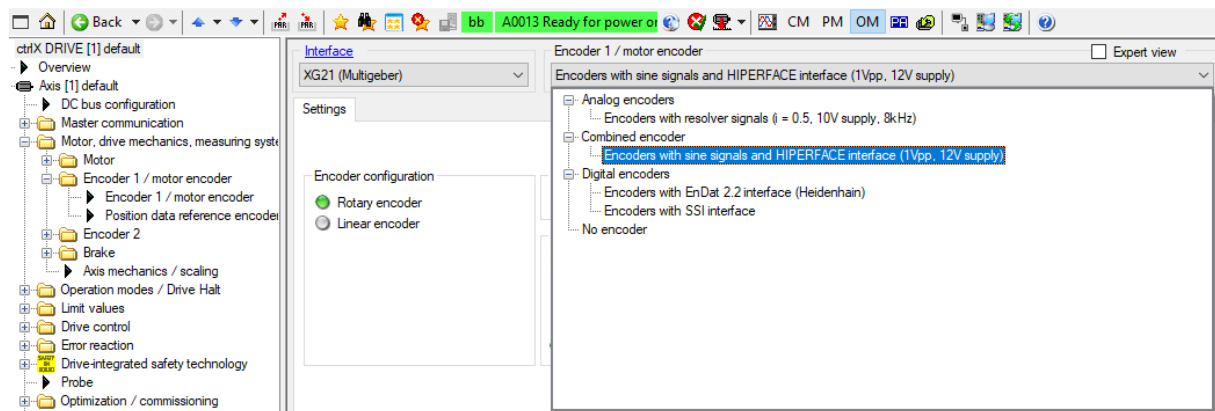## .Selecting the interface and the encoder

Fig. 194: Selecting the encoder interface and the digital encoder in the ctrlX DRIVE Engineering dialog, "HIPERFACE encoder" example
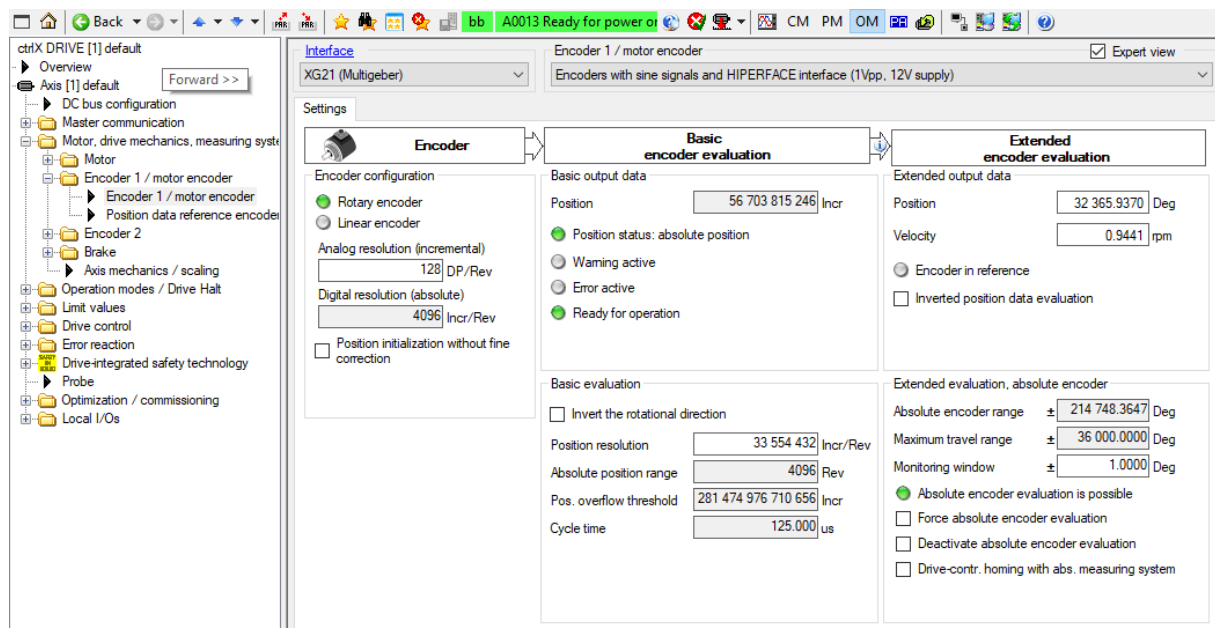

Fig. 195: ctrlX DRIVE Engineering dialog for encoder configuration of a HIPERFACE encoder

For visualization of two-step encoder evaluation ("Basic" and "Extended"), "Expert view" can be activated. Besides the parameters of the basic dialog (red frames), additional parameter values and states mainly relevant for diagnostics are displayed. Additionally, advanced user-side configuration options are displayed and enabled via dialogs:
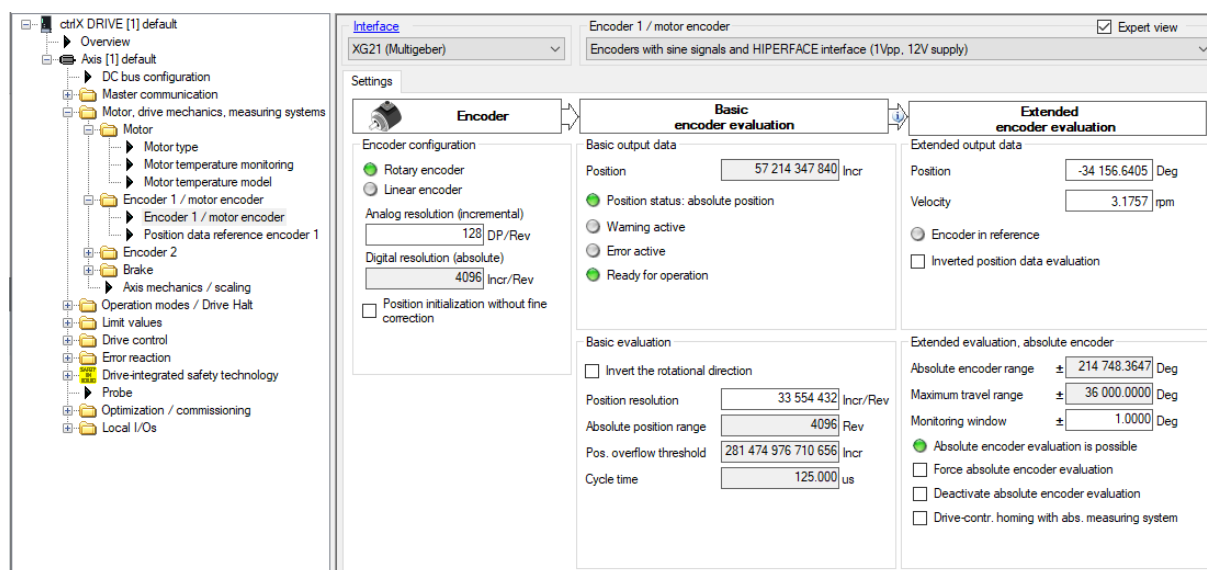
Fig. 196: "Expert view" of the "Settings" dialog for diagnostic purposes and for further configurations

.Encoder diagnostics

Diagnostics of the drive are chronologically listed in the "diagnostic trace" of the controller. The listing in the diagnostic trace can be comfortably displayed in ctrlX DRIVE Engineering. If encoder errors or warnings have occurred, these are first registered in the respective bits of the Basic diagnostic parameter "S-0-0600.x.1, Encoder status" and additionally displayed in the "Expert view" of the encoder settings dialog.

.Additional information and details

. Notes on commissioning for protocol specification of HIPERFACE® interface:

- Telegram length: variable
- Coding: Binary
- Error bits: 1 bit (for commands)
- Parity: 1 bit
- Checksum: 8 bits
- Position bits: 32 bits
- Transmission of position: starting with LSB
- Baud rate: 9600 kBaud (permanently set)

.Specification 1Vpp interface:

- Signal level according to Heidenhain standard (see analog encoders)

.Features of HIPERFACE® encoders

- Relative encoder resolution: S-0-0602.x.21

- Absolute encoder resolution: S-0-0602.x.22 (32 times the relative encoder resolution)
- Single- or multi-turn rotary encoders (S-0-0601.x.23), virtual zero pulse (once per encoder revolution)
- Maximum initialization velocity: 50 rpm or 50mm/min
- Memory range for OEM data

.Firmware-side actual position value generation

- Position display of Basic encoder evaluation of HIPERFACE® encoders: 48 bits
- On transition from CM to PM, the digital absolute position of the encoder is read. This is the initialization position for the high-precision, cyclic position evaluation via the analog sine/cosine signals. The absolute initialization position enables absolute position evaluation within the single-turn or multi-turn range.

.Encoder signal monitoring

- On switching to operating mode, the initialization position of the encoder is checked. In this process, the digital absolute position is compared to the quadrant registered for the sine-cosine signal if position initialization with fine adjustment (default: S-0-0602.x.136) is active. If the initialization position is not "in the correct quadrant", the error bit in "S-0-0600.x.1, Encoder status" is set and the transition command is aborted with an error message.
  On initialization, the digital absolute position is not simultaneously saved with the analog encoder signals. The time offset is corrected up to the maximum initialization velocity on the firmware side. At higher velocity, there is no encoder initialization!
- The sine and cosine signal is monitored for amplitude and interferences.

.Parameterization

For HIPERFACE® encoders, the encoder-specific data are either available in the encoder data memory or they are provided by the drive firmware, depending on the configuration level of the encoder data memory. If used as MSK motor encoder, the encoder data memory also tracks the motor parameter values and identification data. On switching from CM to PM, data and parameter values are automatically loaded to the respective parameters of the drive if...

- the characteristic number for this encoder was entered in S-0-0602.x.1, Phys. Encoder type,

This parameterization/configuration is supported by dialogs in ctrlX DRIVE Engineering, see also ↘ "Commissioning".

> ⓘ Only HIPERFACE® encoder types with data stored in the firmware or with type identifier "0xFF" are supported (see above).

.Diagnostics

- The bits for "error" and "warning" in "S-0-0600.x.1, Encoder status" are set if warning or error states occur.
- The drive recognizes replacement of the encoder or motor type by checking the serial number after activation. If the serial number has changed, position data reference is lost and the axis is no longer homed.

.Data memory range for user data

HIPERFACE® encoders are equipped with encoder data memory and also provide a data memory range for user data (OEM memory range) (according to configuration level 1 or 2, see above) besides provision of their own encoder-specific data. The data are stored in non-volatile form. That is to say, the stored data are maintained in the case of voltage failure. For use as motor encoder for Rexroth housing motors, the motor parameter values and identification data are stored in the OEM memory range and provided with write protection.

Encoders with HIPERFACE® interface

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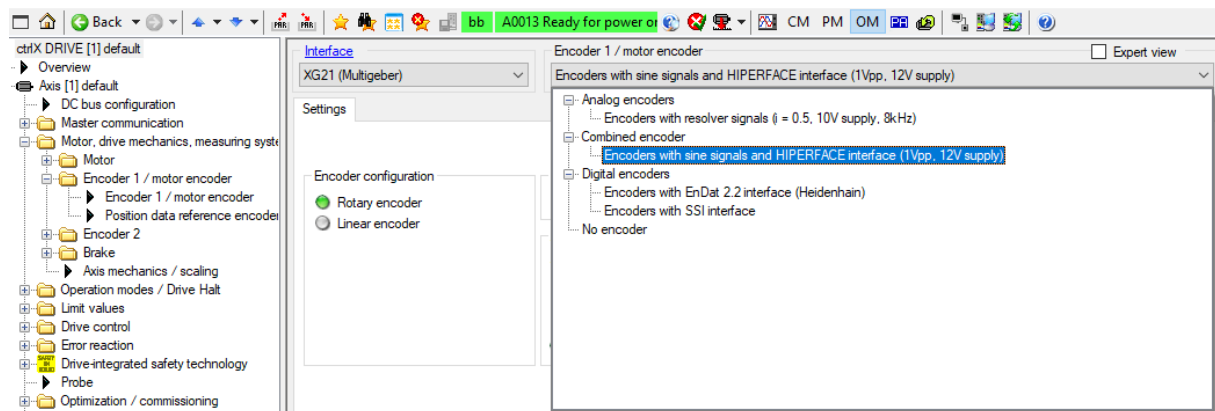## .Selecting the interface and the encoder

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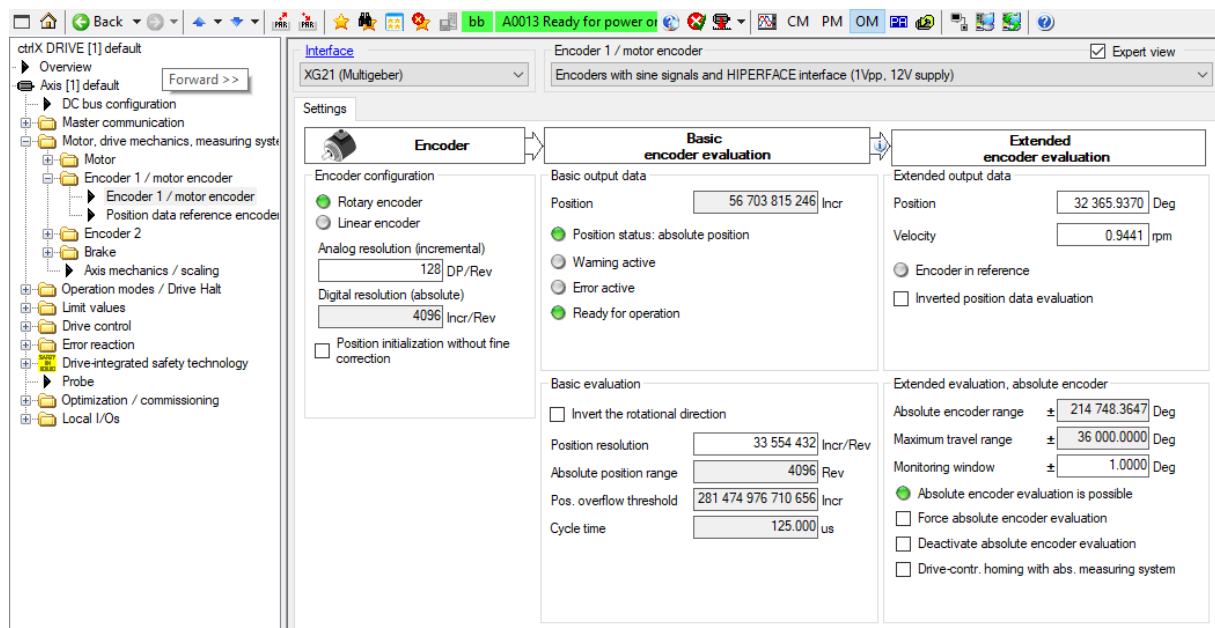

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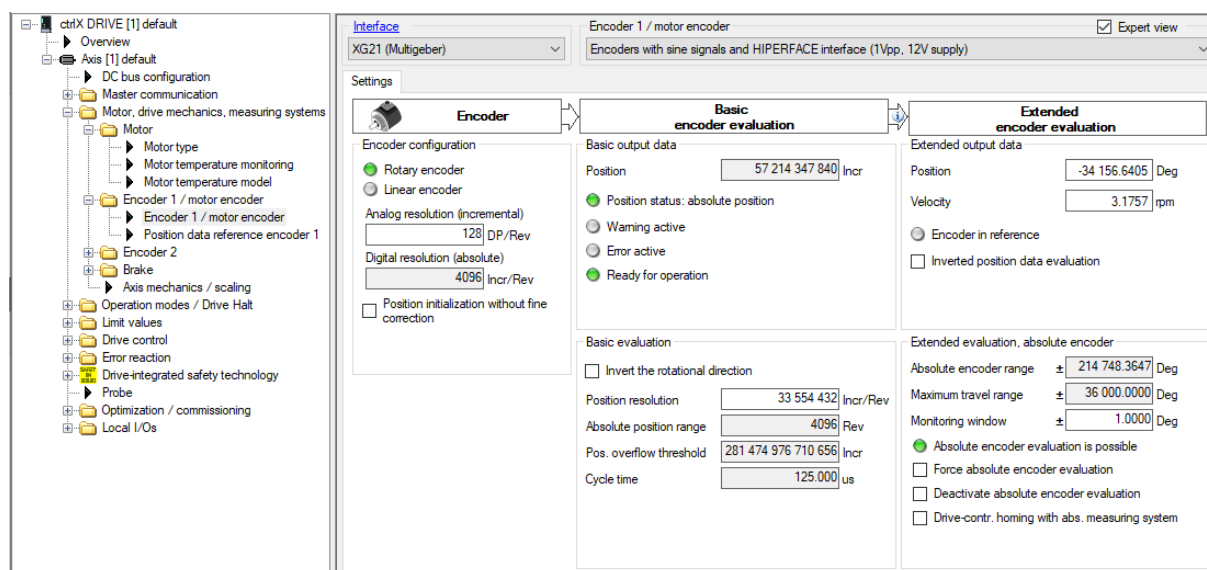
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