

**NCT MOTOR-DRIVE
ENCODER CABLE
ASSEMBLING AND SETTING GUIDE
NCT ELECTRONIC UNITS
DOCUMENTATION**

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PREVIOUS VERSIONS

VERSION NUMBER	VERSION NAME	DESCRIPTION
100	BT	Previous version

INTRODUCTION

This is an assembling guide for making EnDat encoder cable between NCT drives and motors.

NCT Ipari Elektronikai Kft.

1 ENCODER CABLES

1.1 ENDAT ENCODER CABLE

The only encoder cable provided by the NCT is suitable for cabling the encoder.

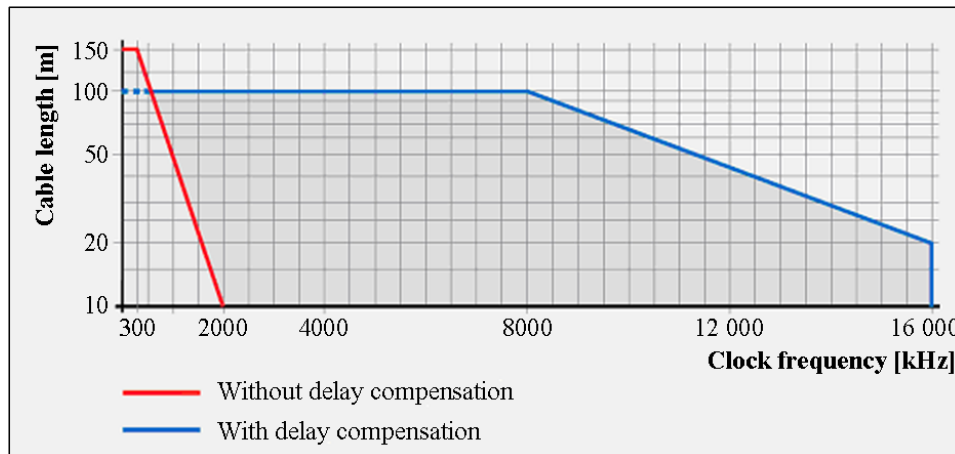
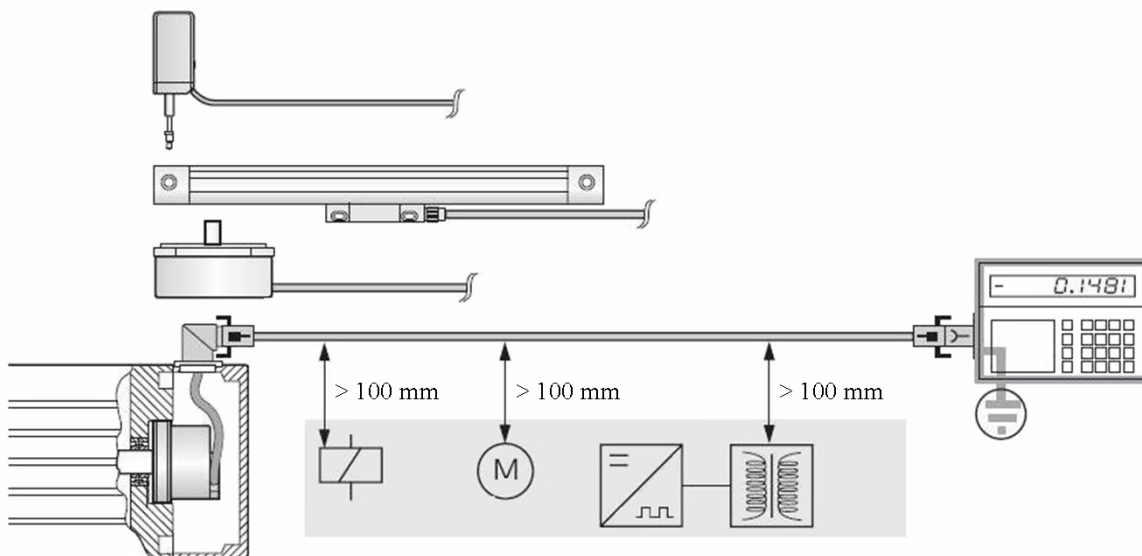


Figure 1 Relationship between EnDat cable length and applicable transmission rate

It is the signal delay compensation mode according to the EnDat 2.2 protocol the NCT drives use at a bit transmission rate of 8000 kHz. As shown in the figure, for cable length up to 100 m the only thing to be done to ensure communication is adhering appropriate mounting distances during completion of machine cabling.

Minimum mounting distance between encoder cables (incremental/EnDat) and several electric sources of interference



Possible electric sources of interference:
 Strong magnetic fields, transformers, brakes and electric motors
 Relays, magnetic switches and magnetic valves
 High-frequency equipment, pulse devices and switch-mode power supply units
 Supply cables for abovementioned devices, AC supply lines

Figure 2 Cable running

Of course, cabling can be realized in accordance with the opportunities, for this reason the rules of running the cables may be violated.

1.2 CABLES OF BATTERY-BUFFERED ENCODERS

For encoders having battery power supply too, another kind of cable connection is required. In any case, it is important that connecting points of the battery shall not to be coupled with the driver. If somehow the battery gets the voltage of +5 V, the battery will be charged and will damage (it will explode or catch fire). In case of application of lithium battery pack or battery it is mandatory to protect energy storage element properly. Heidenhain also applies safety standards. In other words, in case of short circuit occurring because of cabling or soldering defect, wetting or simply encoder error, lithium battery will damage too (it will explode or catch fire). For this reason, it is necessary to limit the battery current in case of short circuit because of related safety standards as well.

In former times there was come up the idea to put battery under the protection cap of motor encoder. Two problems arose at that time. One of them was that the motor with its encoder operated even at the temperature of 100 °C, however the battery could already damage at this temperature (it could also fail according to description), at least its self-discharge current could increase and its life decreased. Furthermore, there may even take place the case during application of the motor, when because of some kind of error water gets under the protection cap. Lithium battery affected by water will also damage. And, when the battery is run down, its replacement is rather difficult.

To protect **lithium battery** against short circuit, it is recommended to insert a **series resistor** to be connected directly to the battery terminals and to be insulated together with the battery using shrinkable tube. The value of the resistor should be **at least 100 Ω, 025 W**.

The Table 1 illustrates proper connections of the encoder cables.

Table 1. Cable connection for battery-buffered encoders

	Encoder	Tail cable	Motor	Cable	Drive	
	15-pin PCB connector		Motor connector	12-pole female right-angle connector	15-pin male D-SUB connector	
U+	13	Brown/Green	2	Brown/Green	5 (14)	+5V
Battery U+	11	Blue	8	Blue	Battery+	+3,6V
Data+	7	Gray	3	Gray	15	DATA+
Data-	8	Pink	4	Pink	13	DATA-
U- (0 V)	14	White/Green	1	White/Green	2 (11)	GND
Clk-	10	Yellow	6	Yellow	12	CLK-
Clk+	9	Purple	7	Purple	4	CLK+
Battery U- (0 V)	12	White	5	White	Battery-	GND
	Housing	Shielding	Housing	Shielding	Housing	

The contacts 5 and 14 and the contacts 2 and 11 of the 15-pin D-SUB connector are connected together inside the drive. It follows from this that the control supply voltage can be obtained from any of these points, but obtaining control supply voltages from both proper points at the same time can also be used. However, in this case coherence of cabling is not kept. It is recommended to connect numbers without parentheses only according to initial cable connection; thus accidental incorrect connections can be avoided.

1.2.1 CONNECTING THE CABLE AND CONNECTOR PLACED INSIDE THE MOTOR

There is a special small 15-pin connector on battery-buffered encoders, connection to which is possible using the only cable purchased from Heidenhain. The Table 1 illustrates colour of the wires in the cable and connection mode of the connector. The other end of the cable runs to a threaded 12-pole M23 male connector.

1.2.2 CONNECTING THE CABLE AND CONNECTOR BETWEEN THE DRIVE AND THE MOTOR

At the motor-side end of the cable there is a threaded 12-pole M23 female connector to provide proper IP protection. At the driver-side end a 15-pin D-SUB connector shall be assembled in the following way.

Wires with the colour illustrated in the Table 1 shall be soldered to the connection points represented in the table. The blue wire and the white wires shall be folded back in the direction of the cable and then a 2-pole battery connector shall be soldered on and insulated using shrinkable tube for safety as it shown in the Figure 4. Thus, having placed the connector housings and being disconnected from the D-SUB connector, powering from battery will be possible. The abovementioned lithium battery with its 2-pole female connector can be connected there. The battery shall be fixed tightly to the cable using cable tie, and a yellow table with black text shall be placed on it warning about inhibition of removing the battery from the encoder, otherwise the encoder loses the absolute position value.

The Figure 4 illustrates a bridge wire which connects the normally connected EnDat encoder cable to the driver in such a way that the battery be connected too. It can be applied in situations where other EnDat encoder (EQN) was already used and replaced by a new type due to failure. In this case it is not required to reconnect the driver-side end of the existing encoder cable; such connecting piece shall be connected only.

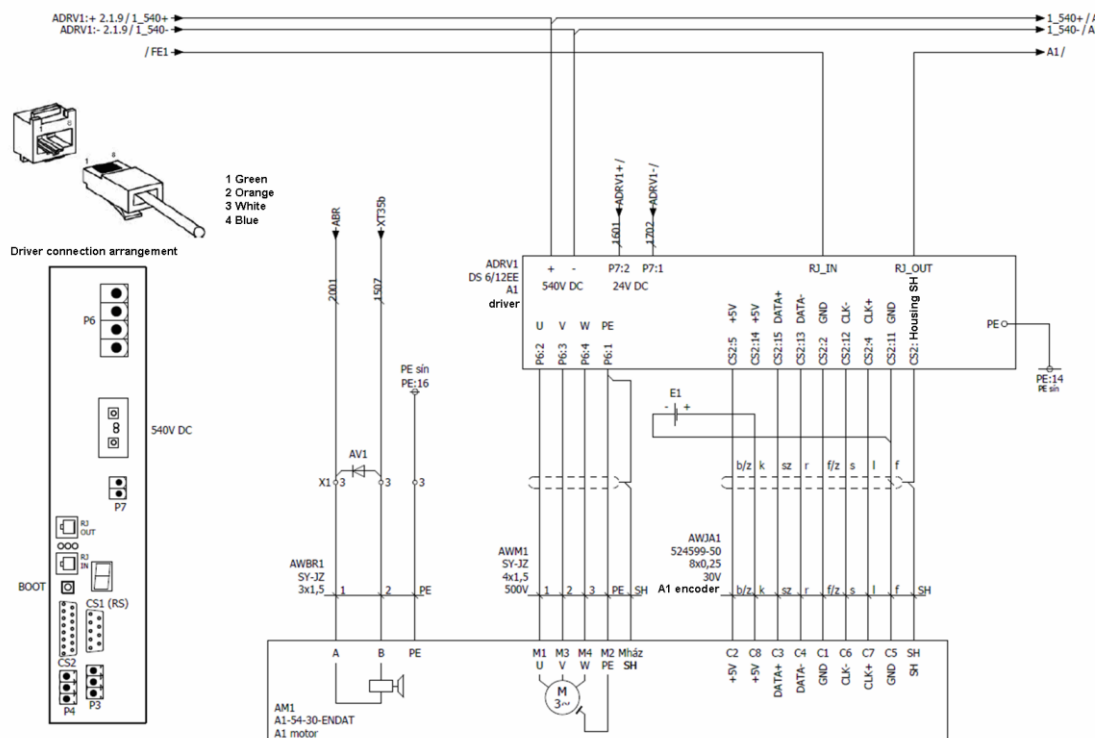


Figure 3 Recommended cabling drawing between NCT motor and drive

If NCT driver is given for the motor equipped with EBI-1135 encoder, please proceed as follows:

1. Assemble the Li-ion battery according to the document BATTERY-PUFFERED EnDat ENCODERS ASSEMBLING GUIDE FOR POWERING WITH BATTERY.
2. The 2-pole male connector shall be added to the 15-pin D-SUB connector, or the factory should procure a Molex 22-29-2021 AE-6410-02A(501) type 2.54 mm (0.100") KK series connector with gold-plated contacts for assembling the encoder cables.



**Figure 4 Cabling with Molex 22-29-2021 AE-6410-02A(501) type 2.54 mm (0.100")
KK series connector with gold-plated contacts**

3. After connection of the battery, disassembling the connection shall be impeded using shrinkable tube. It is very important!
4. There shall be placed the yellow table warning about possible position loss in case of dismantling the connection.