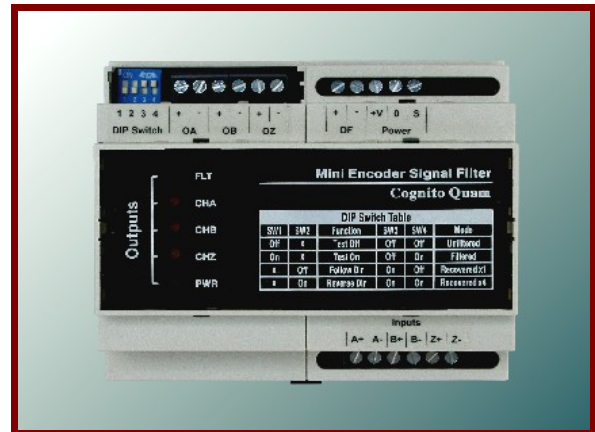


## Multimode Encoder Filter Technology Overview

The encoder, in rotary or linear form, is the most popular motion/position sensor and these filters complement, safeguard, maintain and extend their capabilities and performance.



Terminator multimode encoder signal filter



Mini multimode encoder signal filter

The filters remove all types of electrical noise (common and differential mode, dV/dt transients, ground loop generated etc.) in the encoder signal lines as well as the corrupting effects of mechanical noise and vibration (phantom movement, dither etc.). The filters reconstruct the encoder signals to reflect the correct encoder position and speed signaling. Performance is safeguarded and problems such as:

- Motion system position drift,
- Home reference loss,
- False triggering of the receiving inputs, and
- Receiving input saturation, latch-up or failure

are eliminated.

Their design is characterized by typical industrial application considerations: low ownership costs, standard interfacing, fool-proof installation, transparent operation, results-oriented and all-inclusive design. The filters feature the following operational characteristics:

- They are wired in-line between the encoder and the processing equipment. This minimizes and simplifies wiring, usually one of the most significant costs in an installation,
- They interface in a standard way with the encoder outputs and the processing equipment inputs. This enables installation by a non-specialist as well as widening equipment choice,
- They have no special installation requirements, have small physical dimensions and are transparent in operation, and
- They are readily recyclable and made with lead-free materials for minimal impact to the environment.

Our multimode filters are offered in two standard lines: the fully featured **Terminator** line and the low cost **Mini** line. Both are all-in-one, comprehensive, value-for-money products, each device addressing all and any combination of known encoder application issues. They process digital quadrature encoder signals with the following features and characteristics:

<b>Multimode Frequency Averaging Filter Line Features Overview</b>		
<b>Feature</b>	<b>Terminator Line</b>	<b>Mini Line</b>
<b>Galvanically isolated input and output</b> stages to interrupt unavoidable system ground loops eliminating related noise as well as protecting the input stage of the driven controller from high voltage transients	5 V/ns minimum dV/dt galvanic barrier immunity.	0.1 V/ns minimum dV/dt galvanic barrier immunity.
<b>Four selectable modes of digital processing:</b> 1. <u>Unfiltered</u> : the outputs are buffered replicas of the inputs, 2. <u>Filtered</u> : the encoder inputs are processed for electronic noise only, 3. <u>Recovered x1</u> : the encoder inputs are processed for electronic noise and analyzed for mechanical position to recover corrupted motion sequences. The outputs are in quadrature format and the mark (or index) channel is processed for electrical noise. 4. <u>Recovered x4</u> : Same as the Recovered x1 mode, but with output resolution quadrupling. The output signals are a clock/direction or an up/down pair at four times the input frequency instead of the quadrature format.	Yes	Yes
<b>Test mode.</b> Depending on the chosen mode and sampling frequency, the filter outputs simulate the function of a 1024 ppr encoder.	Output is 1/64 the chosen sampling frequency.	Output frequency is fixed.
<b>Direction reversal.</b> One of the encoder channels can be complemented to effect a direction reversal, thus saving the rewiring/reconnection of the encoder signals.	Yes	Yes
<b>Supply, signal and worn/faulty encoder indication.</b> Five LEDs indicate the status of the power supply, the three encoder channels and the presence of out-of-sequence signalling, typically caused by a worn or faulty encoder.	Yes	Yes
<b>DIP switch selectable options.</b> All operational parameters are set/reset via DIP switches.	Yes	Yes
<b>Independent, galvanically-isolated fault output.</b> The out-of-sequence condition activates this uncommitted optotransistor output interfacing to external systems.	EF24 model only	Yes
<b>Selectable sampling frequency.</b> The encoder signals are DSP processed at selectable frequencies to interface to slower equipment or tune out problem noise sources in particularly difficult applications.	Yes	Yes
<b>Types of EIA(RS)422 input termination.</b>	Standard DC, AC and none	Standard DC and none
<b>Internal dual voltage 115/230 VAC twin supply.</b> Powers the two internally isolated input and output filter sections and can power the monitored encoder with regulated 5 VDC or unregulated 10/15 VDC.	Yes	No. Power must be supplied to each of the input and output filter sections.
<b>Enclosure</b>	Cast aluminium, high noise immunity, IP65	Plastic, DIN rail mountable, IP40
<b>Available speed grades.</b>	High, Standard and Low	Basic only

## The Terminator Line



The Terminator multimode filters are all-in-one, value-for-money products addressing high speed, high noise immunity and high environmental protection requirements.

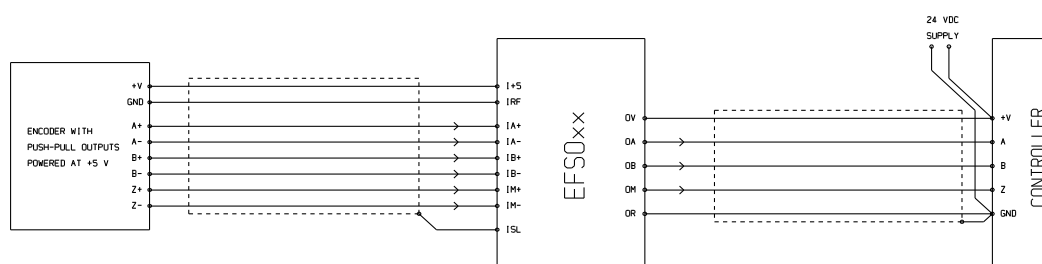
They feature an internal dual voltage 115/230 VAC twin supply which powers the two internally isolated input and output filter sections and can also power the monitored encoder with regulated 5 VDC or unregulated 10/15 VDC.

The line is offered in a range of options which also allow them to be used as interfaces between different encoder and PLC/drive input card signal types. These are:

Model	Single ended input types	Differential input types	Universal 5 V output types	5-30 V output types	Available speed grades
EF24	All 10-28 V types	10-28 V		All types	Low
EFDO		EIA422	EIA422, all single 5V		High, Standard
EFSO	All 5 V, 5-30 V NPN and push-pull only	EIA422		PNP, push-pull	Low
EFU5	All 5 V, 5-30 V NPN and push-pull only	EIA422	EIA422, all single 5V		High, Standard

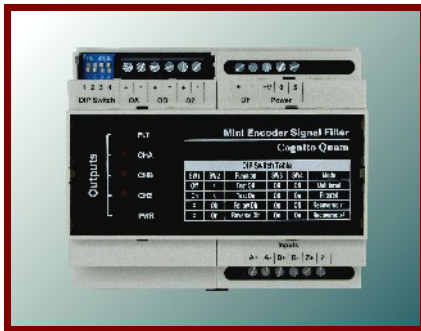
The maximum quadrature input frequency which can be processed by the filters depends on the filter speed grade and function mode as follows:

Speed Version	Unfiltered	Filtered	Recovered x1	Recovered x4
Low	300 kHz	250 kHz	200 kHz	62.5 kHz
Standard	10 MHz	1.5 MHz	1.2 MHz	375 kHz
High	10 MHz	3.0 MHz	2.4 MHz	1.5 MHz



Typical application of an EFSOxx filter powering a physically remote encoder (connected via long cables), processing its differential output signals and interfacing them to a 24 V single input controller.

The Mini Line



The Mini multimode filters are all-in-one, value-for-money products addressing less demanding and low cost needs.

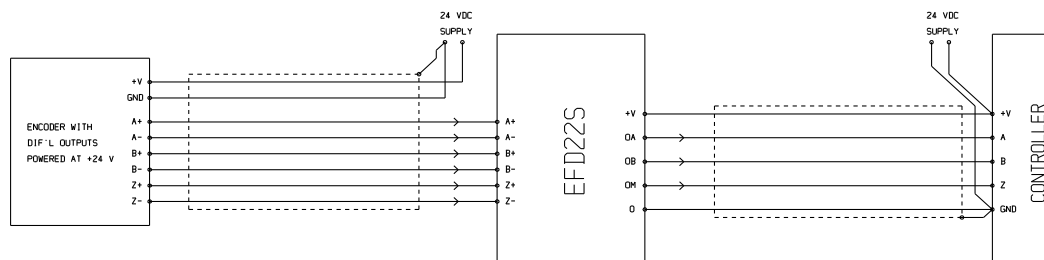
They feature an IP40 DIN rail mountable enclosure and have no internal supply to power the filter input and output sections. The input and output stages are typically powered by the monitored encoder and receiving controller/PLC supplies respectively.

The line is offered in a range of options which also allow them to be used as interfaces between different encoder and PLC/drive input card signal types. These are:

Mini Multimode Encoder Filter Model Selection Table					
Model	Single ended input types	Differential input types	Single ended output types	Differential output types	Power supply
EFD44		EIA422		EIA422	5 VDC (input) and 5 VDC (output)
EFD42S		EIA422	10-28 V PNP and push-pull only		5 VDC (input) and 10-28 VDC (output)
EFD42D		EIA422	All 10-28 V	10-28 V	5 VDC (input) and 10-28 VDC (output)
EFD24	All 10-28 V	All 10-28 V		EIA422	10-28 VDC (input) and 5 VDC (output)
EFD22S	All 10-28 V	All 10-28 V	10-28 V PNP and push-pull only		10-28 VDC (input) and 10-28 VDC (output)
EFD22D	All 10-28 V	All 10-28 V	All 10-28 V	10-28 V	10-28 VDC (input) and 10-28 VDC (output)

The maximum quadrature input frequency which can be processed by the filters depends on the selected function mode as follows:

Maximum Quadrature Input Frequency Capability per Filtering Mode				
Speed Grade	Unfiltered	Filtered	Recovered x1	Recovered x4
Basic	300 kHz	125 kHz	100 kHz	31.3 kHz



Typical application of an EFD22S filter powering a physically remote encoder (connected via long cables), processing its differential output signals and interfacing them to a 24 V single input controller.

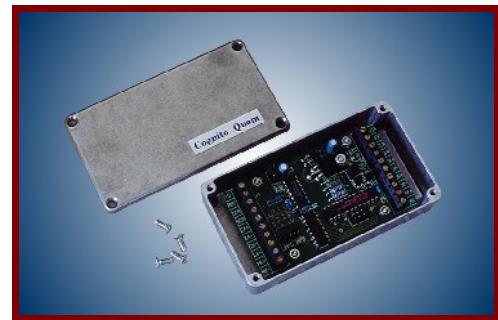
## Other products of interest



The specialty multimode frequency averaging filters, after cleaning-up and ensuring the electrical and low-level integrity of the encoder signals, process these signals to reproduce them at average input frequency.

The technology and its applications are described in document *Multimode Frequency Averaging Filters* (also available from our site <http://www.cognitoquam.gr>).

Our encoder filter technology is also offered in custom versions for OEMs (Original Equipment Manufacturers).



Multimode Encoder Signal Filter Ordering Information				
Model		Description		
Clock/direction x4 output	Up/down x4 output	Filter line	Speed grade	Input → Output
EF2402-ALU-L	EF2402U-ALU-L	Terminator	Low	Universal 10-28 V → Universal 5-30 V
EFDO02-ALU-H	EFDO02U-ALU-H	Terminator	High	EIA(RS)422 → Universal 5 V
EFDO02-ALU-S	EFDO02U-ALU-S	Terminator	Standard	EIA(RS)422 → Universal 5 V
EFSO02-ALU-L	EFSO02U-ALU-L	Terminator	Low	Universal 5 V → PNP/push-pull type 5-30 VDC single ended
EFU502-ALU-H	EFU502U-ALU-H	Terminator	High	Universal 5 V → Universal 5 V
EFU502-ALU-S	EFU502U-ALU-S	Terminator	Standard	Universal 5 V → Universal 5 V
EFD44-DIN-B	EFD44U-DIN-B	Mini	Basic	EIA422 → EIA422
EFD42S-DIN-B	EFD42SU-DIN-B	Mini	Basic	EIA422 → 10-28 V PNP/push-pull single ended
EFD42D-DIN-B	EFD42DU-DIN-B	Mini	Basic	EIA422 → Universal 10-28 V
EFD24-DIN-B	EFD24U-DIN-B	Mini	Basic	Universal 10-28 V → EIA422
EFD22S-DIN-B	EFD22SU-DIN-B	Mini	Basic	Universal 10-28 V → 10-28 V PNP/push-pull single ended
EFD22D-DIN-B	EFD22DU-DIN-B	Mini	Basic	Universal 10-28 V → Universal 10-28 V

### Cognito Quam Profile

Cognito Quam Electrotechnologies Ltd. (established in 1990) is a privately held engineering and commercial company specializing in industrial electronics and their application. The company expertise covers all aspects of applications for the factory environment namely measurement (transducers and sensors), data processing and communication, control and actuation, automation and robotics and power and energy electronics.

Cognito Quam has contributed and been involved in the design and development of the following technologies, machinery and devices:

- Power factor controllers,
- Motor voltage and frequency inverters and converters,
- Thermal load control and management,
- Robotic interfaces and protocol converters,
- Adaptive panel controllers,
- Robotics controllers,
- Variable speed drives,
- Olive oil processing rejects control equipment (FAIR contract),
- Low Voltage and EMC CE marking compliance devices and equipment for production lines,
- Portable dioxine-furan instrumentation (SMT contract),
- Three-phase programmable soft-starters,
- Hard real time job scheduling systems,
- Hard real time industrial distributed data systems (Brite-EuRam subcontract),
- Calibration rig and supplies for power meters,
- Electrical utility Hall effect energy and power meters,
- Industrial data networks,
- Battery chargers and UPS inverters,
- Solar power air conditioning telemetry and control systems (Thermie subcontract)
- Small switching power supplies,
- Multi-port communication PC cards,
- Ship oily water separators, and
- Modem controllers.

Cognito Quam also offers its research and development services in integrating its products in larger industrial systems products as well as in the design of new and challenging devices and equipment. As such the company cooperates closely and supports its customers in their efforts for a better product.