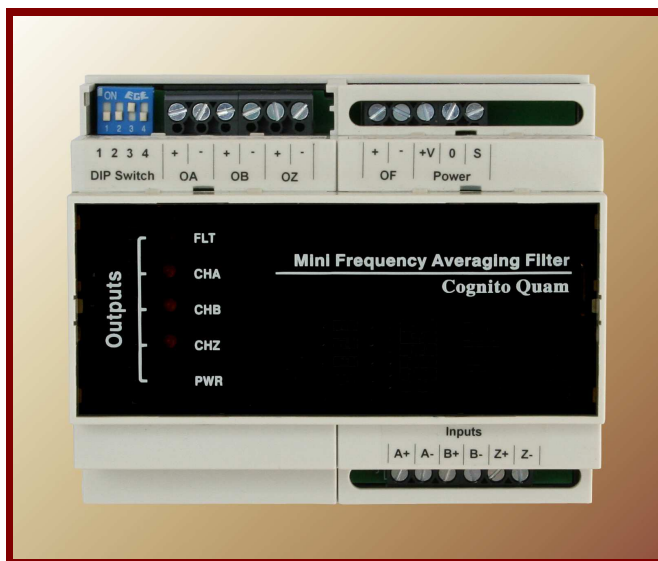## Multimode Frequency Averaging Filters

The multimode frequency averaging filter is the signal processing extension of our well established multimode encoder signal filters. While the signal filters clean-up and ensure the electrical and low-level integrity of the encoder signals, the averaging filters, in addition, process these signals to reproduce them at average input frequency.

This specialty filter is particularly suited to slow moving production lines where the ideal control variable is average, and not instantaneous, speed. This happens because instantaneous speed varies randomly due to external events and systematically due to the various coupled, but uncontrolled, mechanisms to the plant power train. As such instantaneous speed cannot be effectively controlled as its measurement is randomly biased and noisy. In contrast, average speed measurement contains only the net effect of these uncontrolled mechanisms and does not allow them to corrupt speed measurement control.

Mini multimode frequency averaging filter in DIN rail IP40 enclosure

Typical applications of the averaging filters are:

- Slow pipe extrusion lines, where raw material feeding (and cost!) is a function of the long-averaged extrusion speed.

- Reciprocating machinery (such as weaving) speed control, whereby performance, energy and operational costs are optimized by controlling average motion speed,

- Engine speed monitoring and control, where shaft rotation is anything but smooth, and

- Vane or turbine flowmeters, where vane vibration due to turbulent flow corrupts rate or dose measurement

As with its sister products, the filter design is characterized by typical industrial application considerations: low ownership cost, 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.

These unique multimode frequency averaging filters are standard, all-in-one, comprehensive products and process digital encoder quadrature or general clock/direction signals from 1 Hz to 4 kHz and are offered in two standard lines: the fully featured Maxi and the low cost Mini line.

Multimode Frequency Averaging Filter Line Features Overview		
Feature	**Maxi Line**	**Mini Line**
Galvanically isolated input and output 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
Noise and dither prefilter. The inputs are processed for electronic noise and analyzed for mechanical position to recover corrupted motion sequences.	Yes	Yes
Two selectable modes of average calculation: 1. Average displacement period: the encoder displacement is measured over a fixed accumulating time duration and the average frequency is then calculated. With this method measurement time is fixed and the resulting accuracy is variable proportionally increasing with encoder speed, and 2. Average signal period: the encoder period is measured after accumulating a fixed number of displacement pulses and the average frequency is then calculated. With this mode accuracy is fixed and measurement time is inversely proportional to encoder speed.	Yes	Yes
Running average postfilter to smooth the frequency output with selectable sample size.	Yes	Yes
Selectable sample size and measurement time. Measurement sample size and accumulation time is user-selectable for maximum versatility and adaptability.	Yes	Yes
Direction reversal. One of the encoder channels can be complemented to effect a direction reversal, thus saving the rewiring/reconnection of the encoder signals.	Yes	Yes
Supply, signal and worn/faulty encoder indication. 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
Independent, galvanically-isolated fault output interfacing to external systems.	Yes	Yes
DIP switch selectable options. All operational parameters are set/reset via DIP switches.	Yes	Yes
Types of EIA(RS)422 input termination.	Standard DC, AC and none	Standard DC and none
Internal dual voltage 115/230 VAC twin isolated supply. Powers the two internally isolated input and output filter sections and can power the monitored encoder with regulated 5 VDC or unregulated 10 VDC.	Yes	No. Power must be supplied to each of the two filter sections.
Enclosure	Cast aluminium, high noise immunity, IP65	Plastic, DIN rail mountable, IP40

Models are characterized by signal format, input/output type, power supply and enclosure type.

	Multimode Frequency Averaging Filter Model Selection Table				
Model	**Input Format**	**Input Connections**	**Output Connections**	**Internal Power Supply**	**Enclosure**
Mini SFAFDxxx	Clock, Direction, Enable	EIA422 and all 10-28 V types	EIA422 and all 10-28 V types	No	Plastic, IP40, DIN rail
Mini EFAFDxxx	Encoder quadrature A, B, Z	EIA422 and all 10-28 V types	EIA422 and all 10-28 V types	No	Plastic, IP40, DIN rail
Maxi EFADO01	Encoder quadrature A, B, Z	Differential EIA422 only	Differential EIA422 only	Yes	Cast aluminium, IP65
Maxi EFASO01	Encoder quadrature A, B, Z	EIA422 and single ended: all 5 V, 5-30 V NPN and Push-Pull only.	Single ended 5-30 V PNP and Push-Pull only.	Yes	Cast aluminium, IP65
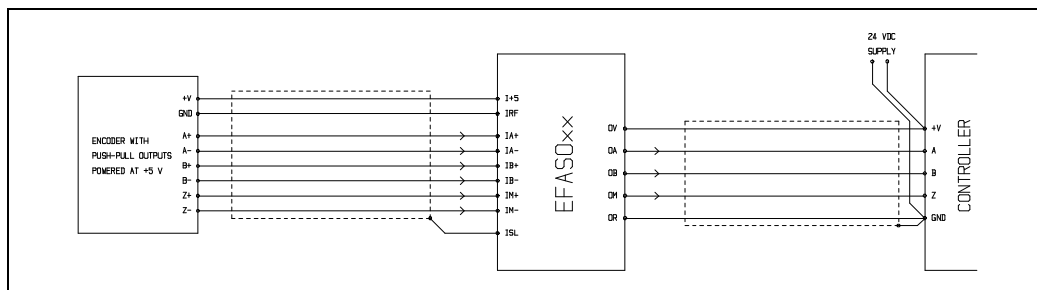
Typical application of an EFASO filter powering a physically remote encoder (connected by long cables), processing its differential output signals and interfacing them to a 24 V single input controller.

Frequency Averaging Filter and Accessories Ordering Information	
Model	**Description**
SFAFD44-DIN	Mini clock/direction frequency averaging filter, EIA422 input, EIA422 output.
SFAFD42S-DIN	Mini clock/direction frequency averaging filter, EIA422 input, 10-28 V single ended PNP and Push-Pull output.
SFAFD42D-DIN	Mini clock/direction frequency averaging filter, EIA422 input, universal 10-28 V output.
SFAFD24-DIN	Mini clock/direction frequency averaging filter, universal 10-28 V input, EIA422 output.
SFAFD22S-DIN	Mini clock/direction frequency averaging filter, universal 10-28 V input, 10-28 V single ended PNP and Push-Pull output.
SFAFD22D-DIN	Mini clock/direction frequency averaging filter, universal 10-28 V input and output.
EFAFD44-DIN	Mini encoder frequency averaging filter, EIA422 input, EIA422 output.
EFAFD42S-DIN	Mini encoder frequency averaging filter, EIA422 input, 10-28 V single ended PNP and Push-Pull output.
EFAFD42D-DIN	Mini encoder frequency averaging filter, EIA422 input, universal 10-28 V output.
EFAFD24-DIN	Mini encoder frequency averaging filter, universal 10-28 V input, EIA422 output.
EFAFD22S-DIN	Mini encoder frequency averaging filter, universal 10-28 V input, 10-28 V single ended PNP and Push-Pull output.
EFAFD22D-DIN	Mini encoder frequency averaging filter, universal 10-28 V input and output.
EFADO01-ALU	Maxi encoder frequency averaging filter, EIA422 inputs and Universal 5 V outputs.
EFASO01-ALU	Maxi encoder frequency averaging filter, Universal 5 V inputs and 5-30 V PNP and Push-Pull single ended type outputs.
XFR400230	Control Voltage Supply Transformer, 90VA, 400/230 VAC (accessory to provide power from 3x400 VAC lines).

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:

- 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.