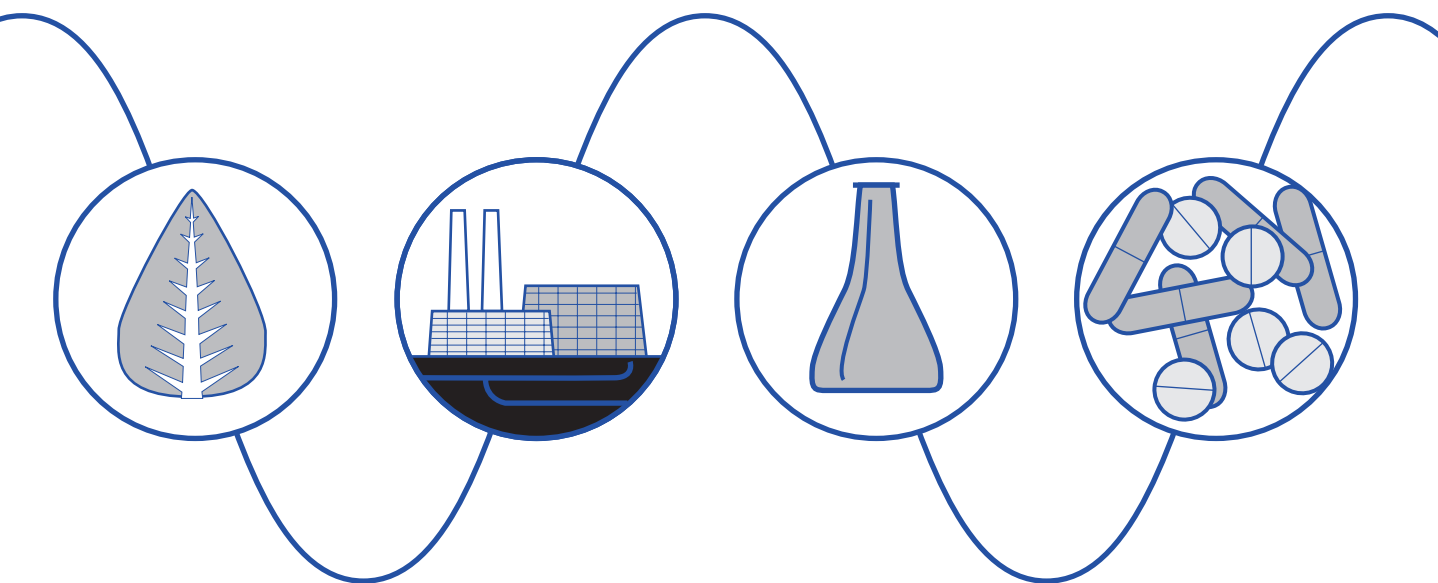


Waters e-SAT/IN Module

Installation Guide



Waters

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Note: When you use the instrument, follow generally accepted procedures for quality control and methods development.

If you observe a change in the retention of a particular compound, in the resolution between two compounds, or in peak shape, immediately determine the reason for the changes. Until you determine the cause of a change, do not rely on the separation results.

Note: The Installation Category (Overvoltage Category) for this instrument is Level II. The Level II Category pertains to equipment that receives its electrical power from a local level, such as an electrical wall outlet.



Atención: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Important : Toute modification sur cette unité n'ayant pas été expressément approuvée par l'autorité responsable de la conformité à la réglementation peut annuler le droit de l'utilisateur à exploiter l'équipement.

Achtung: Jedwede Änderungen oder Modifikationen an dem Gerät ohne die ausdrückliche Genehmigung der für die ordnungsgemäße Funktionstüchtigkeit verantwortlichen Personen kann zum Entzug der Bedienungsbezugnis des Systems führen.

Avvertenza: eventuali modifiche o alterazioni apportate a questa unità e non espressamente approvate da un ente responsabile per la conformità annulleranno l'autorità dell'utente ad operare l'apparecchiatura.

Atención: cualquier cambio o modificación efectuado en esta unidad que no haya sido expresamente aprobado por la parte responsable del cumplimiento puede anular la autorización del usuario para utilizar el equipo.

注意：未經有關法規認證部門允許對本設備進行的改變或修改，可能會使使用者喪失操作該設備的權利。

注意：未經有關法規認證部門明確允許對本設備進行的改變或改裝，可能會使使用者喪失操作該設備的合法性。

주의 : 기기 검교정 담당자의 승인 없이 무단으로 기기를 변경 또는 수정하는 경우에는, 그 기기 운영에 대한 허가가 취소될 수 있습니다.

注意：規制機関から明確な承認を受けずに本装置の変更や改造を行うと、本装置のユーザとしての承認が無効になる可能性があります。



Caution: Use caution when working with any polymer tubing under pressure:

- Always wear eye protection when near pressurized polymer tubing.
- Extinguish all nearby flames.
- Do not use Tefzel tubing that has been severely stressed or kinked.
- Do not use Tefzel tubing with tetrahydrofuran (THF) or concentrated nitric or sulfuric acids.
- Be aware that methylene chloride and dimethyl sulfoxide cause Tefzel tubing to swell, which greatly reduces the rupture pressure of the tubing.

Attention : Soyez très prudent en travaillant avec des tuyaux de polymères sous pression :

- Portez toujours des lunettes de protection quand vous vous trouvez à proximité de tuyaux de polymères.
- Eteignez toutes les flammes se trouvant à proximité.
- N'utilisez pas de tuyau de Tefzel fortement abîmé ou déformé.
- N'utilisez pas de tuyau de Tefzel avec de l'acide sulfurique ou nitrique, ou du tétrahydrofurane (THF).
- Sachez que le chlorure de méthylène et le sulfoxyde de diméthyle peuvent provoquer le gonflement des tuyaux de Tefzel, diminuant ainsi fortement leur pression de rupture.

Vorsicht: Bei der Arbeit mit Polymerschläuchen unter Druck ist besondere Vorsicht angebracht:

- In der Nähe von unter Druck stehenden Polymerschläuchen stets Schutzbrille tragen.
- Alle offenen Flammen in der Nähe löschen.
- Keine Tefzel-Schläuche verwenden, die stark geknickt oder überbeansprucht sind.
- Tefzel-Schläuche nicht für Tetrahydrofuran (THF) oder konzentrierte Salpeter- oder Schwefelsäure verwenden.
- Durch Methylenchlorid und Dimethylsulfoxid können Tefzel-Schläuche quellen; dadurch wird der Berstdruck des Schlauches erheblich reduziert.



Precauzione: prestare attenzione durante le operazioni con i tubi di polimero sotto pressione:

- Indossare sempre occhiali da lavoro protettivi nei pressi di tubi di polimero pressurizzati.
- Estinguere ogni fonte di ignizione circostante.
- Non utilizzare tubi Tefzel soggetti a sollecitazioni eccessive o incurvati.
- Non utilizzare tubi Tefzel contenenti tetraidrofurano (THF) o acido solforico o nitrico concentrato.
- Tenere presente che il cloruro di metilene e il dimetilsolfossido provocano rigonfiamento nei tubi Tefzel, che riducono notevolmente il limite di pressione di rottura dei tubi stessi.

Advertencia: manipular con precaución los tubos de polímero bajo presión:

- Protegerse siempre los ojos en las proximidades de tubos de polímero bajo presión.
- Apagar todas las llamas que estén a proximidad.
- No utilizar tubos Tefzel que hayan sufrido tensiones extremas o hayan sido doblados.
- No utilizar tubos Tefzel con tetrahidrofurano (THF) o ácidos nítrico o sulfúrico concentrados.
- No olvidar que el cloruro de metileno y el óxido de azufre dimetilo dilatan los tubos Tefzel, lo que reduce en gran medida la presión de ruptura de los tubos.

警告：當在有壓力的情況下使用聚合物管線時，小心注意以下幾點：

- 當接近有壓力的聚合物管線時一定要戴防護眼鏡。
- 熄滅附近所有的火焰。
- 不要使用已經被壓扁或嚴重彎曲的特氟隆(Tefzel)管線。
- 不要在特氟隆(Tefzel)管線中使用四氫呋喃(THF)或濃硝酸或濃硫酸。
- 要了解使用二氯甲烷及二甲基亞楓會導致特氟隆(Tefzel)管線膨脹，大大降低管線的耐壓能力。



警告: 当在有压力的情况下使用聚合物管线时, 小心注意以下几点

- 当接近有压力的聚合物管线时一定要戴防护眼镜
- 熄灭附近所有的火焰。
- 不要使用已经被压瘪或严重弯曲的特氟隆 (Tefzel) 管线。
- 不要在特氟隆 (Tefzel) 管线中使用四氢呋喃 (THF) 或浓硝酸或浓硫酸。
- 要了解使用二氯甲烷及二甲基亚砷会导致 特氟隆 (Tefzel) 管线膨胀, 大大降低管线的耐压能力。

경고 : 폴리머재질의 튜빙을 압력하에서 사용할 때는 다음 사항에 유의하십시오.

- 압력을 받은 폴리머 튜빙 부근에서는 반드시 보호안경을 착용할 것
- 모든 화기의 접근을 금함
- 눌리거나 뒤틀린 Tefzel 튜빙은 사용하지 말 것
- Tefzel 튜빙을 테트라히드로퓨란 (THF) 이나 염산 및 황산과 함께 사용하지 말 것
- 디클로로메탄 (methylene chloride) 와 디메틸설폭사이드 (dimethyl sulfoxide) 는 Tefzel 튜빙을 팽창시켜 쉽게 파열되므로 주의할 것

警告: ポリマーチューブに圧力をかけて取り扱う場合は、次のように注意してください。

- 加圧したポリマーチューブの付近では、常に保護めがねを着用してください。
- 付近の火はすべて消してください。
- 激しい応力やねじれを受けたTefzelチューブは使用しないでください。
- テトラヒドロフラン (THF)、濃硝酸、あるいは濃硫酸には、Tefzelチューブを使用しないでください。
- メチレン-クロライドやジメチルスルホキシドはTefzelチューブを膨張させ、チューブの破断圧力を大幅に低下させますので、注意してください。



Caution: The user shall be made aware that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Attention : L'utilisateur doit être informé que si le matériel est utilisé d'une façon non spécifiée par le fabricant, la protection assurée par le matériel risque d'être défectueuses.

Vorsicht: Der Benutzer wird darauf aufmerksam gemacht, dass bei unsachgemäßer Verwendung des Gerätes unter Umständen nicht ordnungsgemäß funktionieren.

Precauzione: l'utente deve essere al corrente del fatto che, se l'apparecchiatura viene usata in un modo specificato dal produttore, la protezione fornita dall'apparecchiatura potrà essere invalidata.

Advertencia: el usuario deberá saber que si el equipo se utiliza de forma distinta a la especificada por el fabricante, las medidas de protección del equipo podrán ser insuficientes.

警告：使用者必須非常清楚如果設備不是按照製造廠商指定的方式使用，那麼該設備所提供的保護將被消弱。

警告：使用者必須非常清楚如果設備不是按照製造廠商指定的方式使用，那麼該設備所提供的保護將被消弱。

경고： 제조사가 지정한 것 이외의 방법으로 기기를 사용하는 경우에는, 사용자가 위험으로부터 보호될 수 없는 경우가 발생할 수 있음에 유념하십시오.

警告：ユーザは製造業者が指定していない方法で装置を使用した場合は装置が提供する保護が損なわれることがあるということを承知しているものとします。



Caution: To protect against fire hazard, replace fuses with those of the same type and rating.

Attention : Remplacez toujours les fusibles par d'autres du même type et de la même puissance afin d'éviter tout risque d'incendie.

Vorsicht: Zum Schutz gegen Feuergefahr die Sicherungen nur mit Sicherungen des gleichen Typs und Nennwertes ersetzen.

Precauzione: per una buona protezione contro i rischi di incendio, sostituire i fusibili con altri dello stesso tipo e amperaggio.

Advertencia: sustituya los fusibles por otros del mismo tipo y características para evitar el riesgo de incendio.

警告：為了避免火災的危險，應更換同種類型及規格的保險絲。

警告：为了避免火灾的危险，应更换同种类型及规格的保险丝。

경고：화재를 방지하기 위해서는 퓨즈 교체 시 같은 종류, 같은 등급의 것을 사용하십시오.

警告：火災の危険防止のために、ヒューズの交換は同一タイプおよび定格のもので行なってください。



Caution: To avoid possible electrical shock, disconnect the power cord before servicing the instrument.

Attention : Afin d'éviter toute possibilité de commotion électrique, débranchez le cordon d'alimentation de la prise avant d'effectuer la maintenance de l'instrument.

Vorsicht: Zur Vermeidung von Stromschlägen sollte das Gerät vor der Wartung vom Netz getrennt werden.

Precauzione: per evitare il rischio di scossa elettrica, scollegare il cavo di alimentazione prima di svolgere la manutenzione dello strumento.

Precaución: para evitar descargas eléctricas, desenchufe el cable de alimentación del instrumento antes de realizar cualquier reparación.

警告：要避免觸電，請在修理或保養器材前把電源線拔出。

警告：为避免可能引起得触电危险，在修理前请切断电源连接。

경고: 전기 충격의 가능성을 피하기 위해서는, 기기를 수리하기 이전에 전원 코드를 차단하십시오.

警告：感電の危険性を避けるために、装置の保守を行う前には装置の電源コードを引き抜いてください。

Commonly Used Symbols

	Direct current Courant continu Gleichstrom Corrente continua Corriente continua 直流電 直流电 직류 直流
	Alternating current Courant alternatif Wechselstrom Corrente alternata Corriente alterna 交流電 交流电 교류 交流
	Protective conductor terminal Borne du conducteur de protection Schutzleiteranschluss Terminale di conduttore con protezione Borne del conductor de tierra 保護的導線端子 保护性的接地端 보호 도체 단자 接地

Commonly Used Symbols (Continued)

	Frame or chassis terminal Borne du cadre ou du châssis Rahmen- oder Chassisanschluss Terminale di struttura o telaio Borne de la estructura o del chasis 結構或底盤端子 机架或底盘接地端 프레임 또는 틀 단자 フレームまたはシャーシアース
	Caution or refer to manual Attention ou reportez-vous au guide Vorsicht, oder lesen Sie das Handbuch Prestare attenzione o fare riferimento alla guida Actúe con precaución o consulte la guía 小心或查閱手冊 小心或查閱手冊 경고 또는 사용설명서 참조 警告またはマニュアルを参照
	Caution, hot surface or high temperature Attention, surface chaude ou température élevée Vorsicht, heiße Oberfläche oder hohe Temperatur Precauzione, superficie calda o elevata temperatura Precaución, superficie caliente o temperatura elevada 警告，熱表面或高溫 警告,热表面或高温 경고, 뜨거운 표면 또는 고온 警告、熱くなっている面、あるいは高温

Commonly Used Symbols (Continued)

	Caution, risk of electric shock (high voltage) Attention, risque de commotion électrique (haute tension) Vorsicht, Elektroschockgefahr (Hochspannung) Precauzione, rischio di scossa elettrica (alta tensione) Precaución, peligro de descarga eléctrica (alta tensión) 警告, 小心触電 (高壓電) 警告, 小心触电 (高压电) 경고, 전기충격의 위험 (고압) 警告、電気ショックの危険性 (高電圧)
	Caution, risk of needle-stick puncture Attention, risques de perforation de la taille d'une aiguille Vorsicht, Gefahr einer Spritzenpunktierung Precauzione, rischio di puntura con ago Precaución, riesgo de punción con aguja 警告, 小心尖狀物刺傷 警告, 小心尖狀物刺伤 경고, 뾰족한 것으로부터의 상해 위험 警告、ニードルで穴をあける危険性
	Caution, ultraviolet light Attention, rayonnement ultraviolet Vorsicht, Ultraviolettes Licht Precauzione, luce ultravioletta Precaución, emisiones de luz ultravioleta 警告, 紫外光 警告, 紫外光 경고, 자외선 警告、紫外線

Commonly Used Symbols (Continued)

	Fuse Fusible Sicherung Fusibile Fusible 保險絲 保险丝 퓨즈 ヒューズ
1	Electrical power on Sous tension Netzschalter ein Alimentazione elettrica attivata Alimentación eléctrica conectada 開啓電源 接通电源 전원 켜기 電源オン
0	Electrical power off Hors tension Netzschalter aus Alimentazione elettrica disattivata Alimentación eléctrica desconectada 關閉電源 切断电源 전원 끄기 電源オフ

Waters e-SAT/IN Module Information

Intended Use

The Waters[®] e-SAT/IN[™] module is used to translate analog signals to digital signals for data collection. The device can be operated with instruments that are used for in-vitro diagnostic testing to analyze many compounds, including diagnostic indicators and therapeutically monitored compounds. When you develop methods, follow the "Protocol for the Adoption of Analytical Methods in the Clinical Chemistry Laboratory," *American Journal of Medical Technology*, 44, 1, pages 30–37 (1978). This protocol covers good operating procedures and techniques necessary to validate system and method performance.

Biological Hazard

When you analyze physiological fluids, take all necessary precautions and treat all specimens as potentially infectious. Precautions are outlined in "CDC Guidelines on Specimen Handling," *CDC – NIH Manual*, 1984.

Calibration

Follow acceptable methods of calibration with pure standards to calibrate methods. Use a minimum of five standards to generate a standard curve. The concentration range should cover the entire range of quality-control samples, typical specimens, and atypical specimens.

Quality Control

Routinely run three quality-control samples. Quality-control samples should represent subnormal, normal, and above-normal levels of a compound. Ensure that quality-control sample results are within an acceptable range, and evaluate precision from day to day and run to run. Data collected when quality-control samples are out of range may not be valid. Do not report this data until you ensure that chromatographic system performance is acceptable.

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Preface

The *Waters e-SAT/IN Module Installation Guide* contains information needed to install the e-SAT/IN™ module. The e-SAT/IN module translates analog signals to digital signals, and transmits those signals using Ethernet TCP/IP communications.

Note: *Perform all procedures in the order specified in this guide.*

This guide is intended for users familiar with computers and software, and who must install and use the e-SAT/IN module. This guide assumes that a dedicated local area network (LAN) is installed throughout the laboratory and that a functional network interface card (NIC) is installed in the host computer and working properly.

Organization

This guide contains the following:

[Chapter 1](#) describes the e-SAT/IN module and its application with other instruments of a chromatography system.

[Chapter 2](#) describes procedures for unpacking, preparing the site, and connecting the e-SAT/IN module to the dedicated LAN and other devices.

[Chapter 3](#) describes the power-on sequence and using the e-SAT/IN module.

[Appendix A](#) provides e-SAT/IN module specifications.

[Appendix B](#) lists part numbers for spare parts and accessories.

Related Documentation

Waters Licenses, Warranties, and Support: Provides software license and warranty information, describes training and extended support, and tells how Waters® handles shipments, damages, claims, and returns.

Online Documentation

Empower Help: Describes all Empower™ windows, menus, menu selections, and dialog boxes for the base software and all the software options. Also includes reference information and procedures for performing all tasks required to use the Empower software. Included as part of the Empower software.

Empower Read Me File: Describes product features and enhancements, helpful tips, installation and/or configuration considerations, and changes since the previous software version.

Printed Documentation for Base Product

Empower System Installation and Configuration Guide: Describes Empower software installation, including the stand-alone Personal workstation, Workgroup configuration, and the Enterprise client/server system. Discusses how to configure the computer and chromatographic instruments as part of the Empower System. Also covers the installation, configuration, and use of acquisition servers such as the LAC/E³² module, the busLAC/E™ card, and interface cards used to communicate with serial instruments.

Empower System Upgrade and Configuration Guide: Describes how to add hardware and upgrade the Empower software using an import-and-export upgrade method.

Empower Software Release Notes: Contains last-minute information about the product. Also provides supplementary information about specific Empower software releases.

Documentation on the Web

Related product information and documentation can be found on the World Wide Web. Our address is <http://www.waters.com>.

Related Adobe Acrobat Reader Documentation

For detailed information about using Adobe® Acrobat® Reader, see the *Adobe Acrobat Reader Online Guide*. This guide covers procedures such as viewing, navigating, and printing electronic documentation from Adobe Acrobat Reader.

Printing This Electronic Document

Adobe Acrobat Reader lets you easily print pages, page ranges, or the entire document by selecting **File > Print**. For optimum print quantity, Waters recommends that you specify a PostScript® printer driver for your printer. Ideally, use a printer that supports 600 dpi print resolution.

Documentation Conventions

The following conventions can be used in this guide:

Convention	Usage
Purple	Purple text indicates user action such as keys to press, menu selections, and commands. For example, "Click Next to go to the next page."
Italic	Italic indicates information that you supply such as variables. It also indicates emphasis and document titles. For example, "Replace <i>file_name</i> with the actual name of your file."
Courier	Courier indicates examples of source code and system output. For example, "The SVRMGR> prompt appears."
Courier Bold	Courier bold indicates characters that you type or keys you press in examples of source code. For example, "At the LSNRCTL> prompt, enter set password oracle to access Oracle."
Underlined Blue	Indicates hypertext cross-references to a specific chapter, section, subsection, or sidehead. Clicking this topic using the hand symbol brings you to this topic within the document. Right-clicking and selecting Go Back from the shortcut menu returns you to the originating topic. For example, "Binary coded decimal input signals are described in Section 1.2.5, BCD Input. "
Keys	The word <i>key</i> refers to a computer key on the keypad or keyboard. <i>Screen keys</i> refer to the keys on the instrument located immediately below the screen. For example, "The A/B screen key on the 2414 Detector displays the selected channel."
...	Three periods indicate that more of the same type of item can optionally follow. For example, "You can store <i>filename1</i> , <i>filename2</i> , ... in each folder."
>	A right arrow between menu options indicates you should choose each option in sequence. For example, "Select File > Exit " means you should select File from the menu bar, then select Exit from the File menu.

Notes

Notes call out information that is helpful to the operator. For example:

Note: *Record your result before you proceed to the next step.*

Attentions

Attentions provide information about preventing damage to the system or equipment. For example:



Attention: *To avoid damaging the detector flow cell, do not touch the flow cell window.*

Cautions

Cautions provide information essential to the safety of the operator. For example:



Caution: *To avoid burns, turn off the lamp at least 30 minutes before removing it for replacement or adjustment.*



Caution: *To avoid electrical shock and injury, unplug the power cord before performing maintenance procedures.*



Caution: *To avoid chemical or electrical hazards, observe safe laboratory practices when operating the system.*

Chapter 1

Introduction

This chapter provides an overview of the Waters® e-SAT/IN™ module.

1.1 About the e-SAT/IN Module

The Waters e-SAT/IN (Ethernet-SATellite Interface) module ([Figure 1-1](#)) is a single-time base, dual-channel, analog-to-digital (A/D) converter. A data acquisition system (Empower™) can collect data from either a single channel or both analog channels. The data start and stop times are identical for both channels.

The e-SAT/IN module uses a dedicated local area network (LAN) to communicate to the chromatography data acquisition computer. You can control the e-SAT/IN module using Waters Empower software.

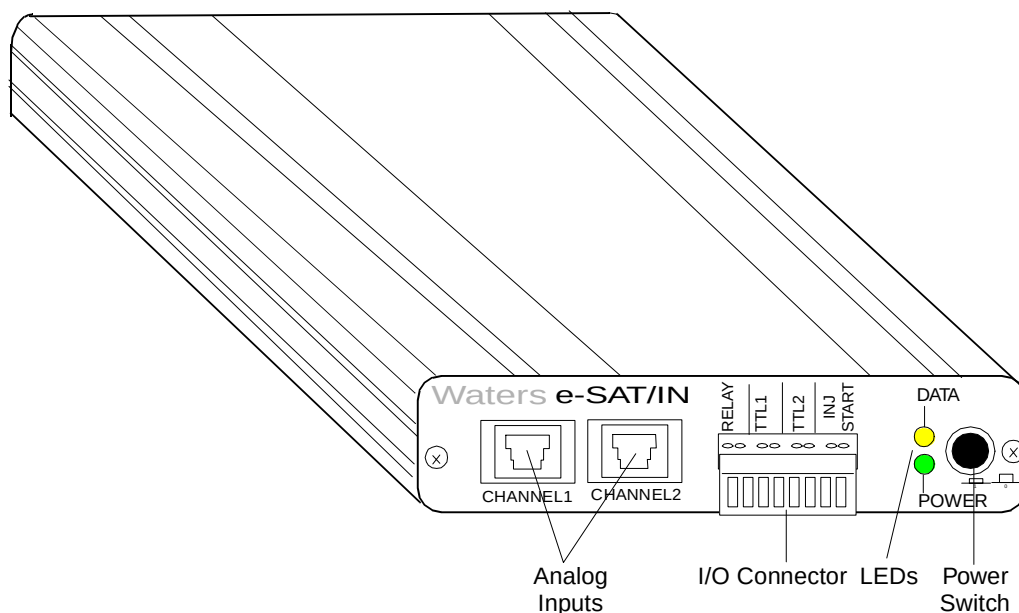


Figure 1-1 e-SAT/IN Module, Front View

The e-SAT/IN module provides the following:

- Software-selectable setting for local power line input frequency (50 or 60 Hz).
- Fixed data acquisition rates at 50 or 60 Hz from 2 to 480 samples per second (Hz). Refer to [Table 1-1](#) for specific sampling rates.
- Up to 24-bits of A/D conversion, depending on the sampling rate.
- Internal storage buffer (225 K) with a capacity of 1 minute of data when both channels are operating at a data rate of 100 samples per second.
- One Ethernet 10 base-T connector for communication.
- Two analog data input channels.
- One BCD input port.
- Three programmable event outputs. Two use TTL and one uses relay event output.
- Self-test and internal calibration at power-on.
- Power-on self-test status indicator (LED).
- Data status indicator (LED).
- Dedicated external voltage autosensing power supply.

1.2 Features

This section describes the features of the e-SAT/IN module.

1.2.1 Baseline Noise

As analysis times decrease, higher data sampling rates are required to accommodate narrower peaks. The e-SAT/IN module features new technology and a design that reduces chromatographic baseline noise at all its sampling rates.

Chromatography data requirements have advanced allowing shorter run times, higher data rates, and lower limits of detection. Technological advances with the latest A/D converters and surface-mounted device design have shown that noise can be significantly reduced at higher data rates if the data sampling rate is synchronized to the “local” power line input frequency. For optimum performance, you must select a line frequency, then select a data rate from a list of values appropriate to the line frequency (see [Table 1-1](#)).

1.2.2 Sampling Rates

To minimize baseline noise, you can optimize sampling rates to the frequency of the local power line environment, either 50 or 60 Hz.

The Instrument Method Editor contains a field to select the power line frequency. This value does not affect the actual power (line frequency) supplied to the instrument, but will allow you to select optimum sampling rates that are set to the selected frequency.

When using data rates above 10 samples per second, a method developed for use throughout global locations where power source frequencies differ can be optimized so that either:

- The method is the same in all geographies, but may have slightly higher baseline noise in some areas.
- The method has the lowest baseline noise in all geographies, but will require different sampling rates.

Table 1-1 AC Line Frequency Sampling Rates

50-Hz AC Line Frequency	60-Hz AC Line Frequency
400 (samples per second)	480 (samples per second)
200	240
100	120
50	60
25	30
12.5	15
10	10
5	5
2	2

1.2.3 Ethernet I/O Connection

The Waters e-SAT/IN module connects to a chromatography data system using a 10 base-T Ethernet interface to a dedicated local area network (LAN). Ethernet allows for the use of long cables (when required) and eliminates the need for proprietary interface hardware beyond the dedicated Ethernet card (network interface card) within the acquisition computer.

1.2.4 Analog to Digital Conversion

Most detectors provide an analog output that must be converted to digital format to be read by a chromatography data acquisition system. Analog signals from different detectors can vary in size, shape, and rate. The e-SAT/IN module provides up to 24-bits of A/D conversion (depending on the sampling rate).

Analog Input Channels

The analog input channels of the e-SAT/IN module receive analog signals from the detector. This analog signal is converted to digital data. The digital data signal is bundled into a data packet and sent using Ethernet to the acquisition computer as shown in [Figure 1-2](#).

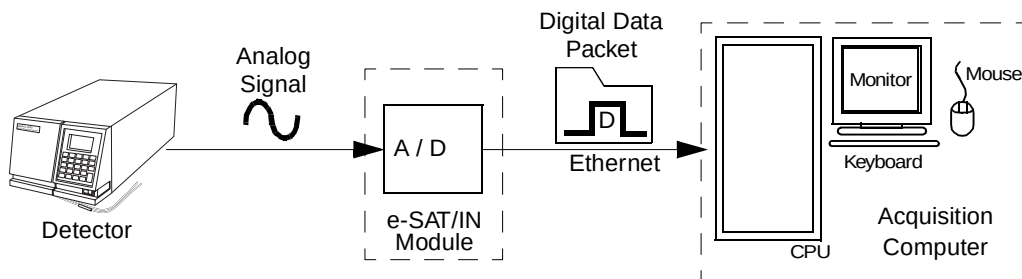


Figure 1-2 Signal Flow

1.2.5 BCD Input

The BCD (binary coded decimal) input records the BCD output from chromatography autosamplers. Many chromatography autosamplers have BCD output capability to document the vial number of the injection that was made. Binary coded decimal input signals numbered 0 to 99 are bundled into the data packet and sent using Ethernet to the acquisition computer. The autosampler output should be compatible with the e-SAT/IN BCD input configuration. Refer to [Section 2.7, Connecting the BCD Cable](#), and [Table 2-2](#).

1.2.6 Programmable Event Outputs

The e-SAT/IN module provides three programmable event outputs as shown in [Table 1-2](#).

Table 1-2 Programmable Event Channels

Programmable Event Channel	Trigger Methods	Reference Voltage	
		High (ON)	Low (OFF)
Relay	Solid-state relay	N/A	N/A
TTL1	TTL	>3.5 Vdc	<0.8 Vdc
TTL2	TTL	>3.5 Vdc	<0.8 Vdc

Each event channel can be programmed to one of the following states:

- On
- Off
- Pulse (a single pulse during run time)
- Repetitive pulse (repeated pulses with a programmable frequency during run time)

Note: The default pulse interval is .02 minutes. When Pulse or Repetitive pulse is selected, the interval can be set from .02 to 100 minutes.

1.2.7 Power-On Self-Tests

After powering on the e-SAT/IN module, it performs self-tests to determine that the unit is functional. When the power-on self-test sequence is completed successfully, the green LED indicator shows that the unit is requesting an IP address. Refer to [Section 3.1.1](#) for indicator details.

1.2.8 IP Address Sequence

The green LED indicator shows that the e-SAT/IN module is requesting IP configuration information by blinking. After the module receives its IP configuration information, the LED remains on and the e-SAT/IN module is ready for use. Refer to [Section 3.1.1](#) for indicator details.

1.2.9 External Power Supply

The Waters e-SAT/IN module uses an external power supply that is provided with the device. The power supply automatically adjusts to the AC input line voltage, and provides the proper DC voltage to the e-SAT/IN module. A separate AC power supply cable is provided for the country in which it will be installed.

The DC power cable connector is designed with a locking mechanism that latches to the power input connector in the e-SAT/IN module. This eliminates accidental disconnection of the power cable during operation. You must mechanically unlatch the connector when disconnecting it. Refer to [Figure 2-7](#).



Attention: Failure to unlatch the DC power connector before disconnecting can damage the connector.



Attention: Use only a Waters e-SAT/IN power supply module to power your e-SAT/IN module. Substitute power supplies can damage the e-SAT/IN module and void your warranty.

Chapter 2

Installing the Module

This chapter provides information you need to install a single e-SAT/IN module or a multiple e-SAT/IN system.

2.1 Selecting the Site

Install the e-SAT/IN module in a laboratory location that meets the following conditions:

- Install the e-SAT/IN module up to 100 meters (320 feet) from the acquisition computer or the Ethernet switch.
- Locate the e-SAT/IN module within 2 meters (6.6 feet) (maximum analog cable length) from the detector(s) to which it is to be connected.
- Locate the e-SAT/IN module within 1.5 meters (4.9 feet) (maximum BCD cable length) from the autosampler to which it is to be connected.
- Do not install the e-SAT/IN module and the associated network components where they can be subjected to fluidic leaks.
- Do not install the e-SAT/IN module close to devices that emit high levels of electromagnetic interference (EMI) or radio frequency interference (RFI).
- Use only grounded AC power receptacles to turn on the e-SAT/IN module power supply.
- When using an Ethernet switch (multiple-connection terminal) in a multiple-module system configuration, set the Ethernet switch in a central physical location within the system.
- Install the e-SAT/IN modules in an equipment rack using DIN rails.

2.2 Making Electrical Connections

For proper operation, system instrumentation always requires a properly grounded AC power supply with no abrupt voltage fluctuations. A power conditioning device may be required for microprocessor-controlled devices when the voltage source is unstable. Contact your Waters Technical Representative for advice.

2.3 Installing the Network Interface Card

The network interface card (NIC) is used to communicate with the e-SAT/IN module. The card must be addressed properly to allow communications to become established between the acquisition computer and the e-SAT/IN module.

The NIC should be installed in an acquisition workstation by either your MIS or IT department or your Waters Technical Service Representative.

Use the following TCP/IP settings:

- IP address: 192.168.0.1
- Sub-net mask: 255.255.255.0



Attention: Contact Waters Technical Service for an alternate TCP/IP address if the listed settings are not available.

2.4 Connecting the Ethernet Cable

2.4.1 Ethernet Connections

The e-SAT/IN module communicates with the acquisition computer through the dedicated local area network (LAN). At the acquisition computer, an installed network interface card (NIC) printed circuit board (customer supplied) provides the interface that allows communication to occur.

You must install the e-SAT/IN module software driver in the acquisition computer before the computer will recognize the presence of the e-SAT/IN module. Refer to the software installation instructions that accompanies the Empower Software Instrument Driver disk.

2.4.2 Single e-SAT/IN Module Connection

In a single e-SAT/IN module system configuration, the connection hardware requires only one standard Ethernet cable along with a modular coupler and Ethernet crossover cable. Refer to [Figure 2-1](#).

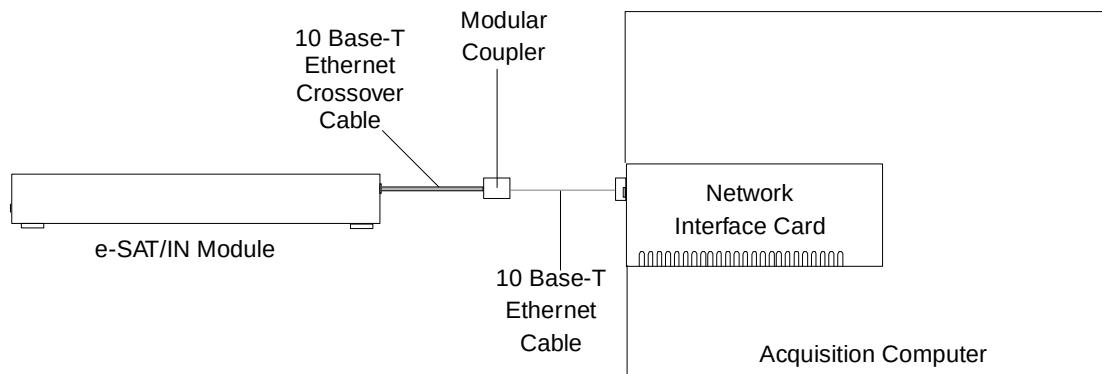


Figure 2-1 Single e-SAT/IN Ethernet Connection

2.4.3 Multiple e-SAT/IN Connections

In the multiple e-SAT/IN module system configuration, when several data channels are needed, a network switch is required to multiplex the communication between e-SAT/IN modules and the acquisition computer. The Ethernet switch allows you to connect multiple e-SAT/IN modules to the acquisition computer. The acquisition computer identifies each e-SAT/IN module by its network address.

Connection hardware requires one standard 10 base-T Ethernet cable per e-SAT/IN module, and a standard 10 base-T Ethernet cable to connect between the network switch output port and the acquisition computer. Refer to [Figure 2-2](#).

You must install the e-SAT/IN module software driver in the acquisition computer before the computer will recognize the presence of the e-SAT/IN module. Refer to the software installation instructions that accompanies the Empower Software Instrument Driver Disk.

2.4.4 Network Installation Guidelines

Multiple e-SAT/IN module configurations use a local area network. This dedicated LAN network requires a design based on the following guidelines:

- 10 base-T, 10 Mbps unshielded twisted-pair (UTP) cable
- A maximum distance of 100 meters (328 feet)
- An RJ45, eight-pin connector to terminate the 10 base-T twisted-pair cable
- The use of a hub in this network configuration is *not* supported.

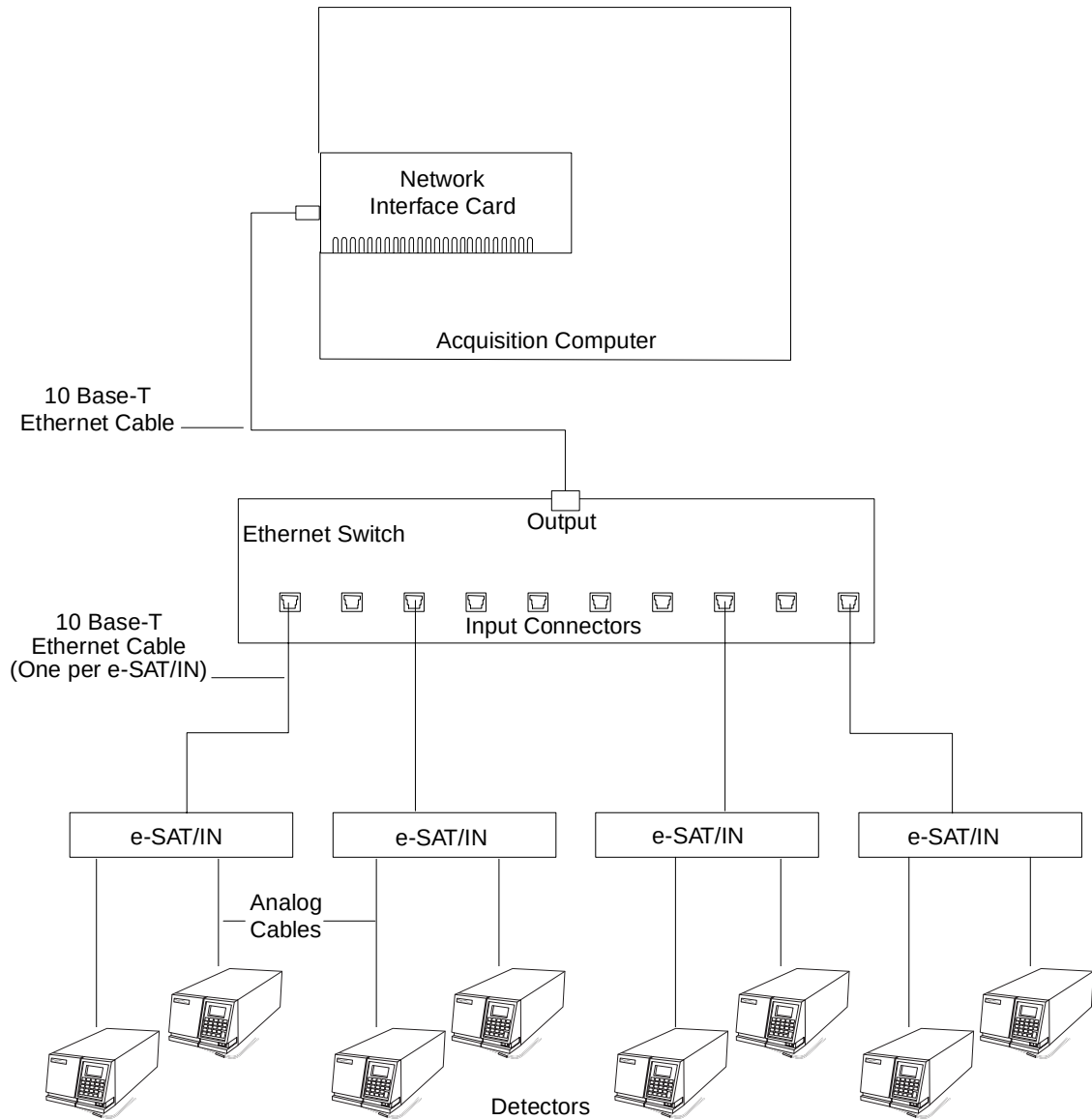


Figure 2-2 Multiple e-SAT/IN Ethernet Connections

2.4.5 Integrating an e-SAT/IN Module to an Existing busSAT/IN System

The e-SAT/IN module can be integrated to an existing busSAT/IN configuration. You must connect the e-SAT/IN module (or Ethernet switch for multiple e-SAT/IN module configurations) to a network interface card (NIC) (customer supplied) within the acquisition computer.

You must install the e-SAT/IN module software driver in the acquisition computer before the computer will recognize the presence of the e-SAT/IN module. Refer to the software installation instructions that accompanies the Empower Software Instrument Driver Disk.

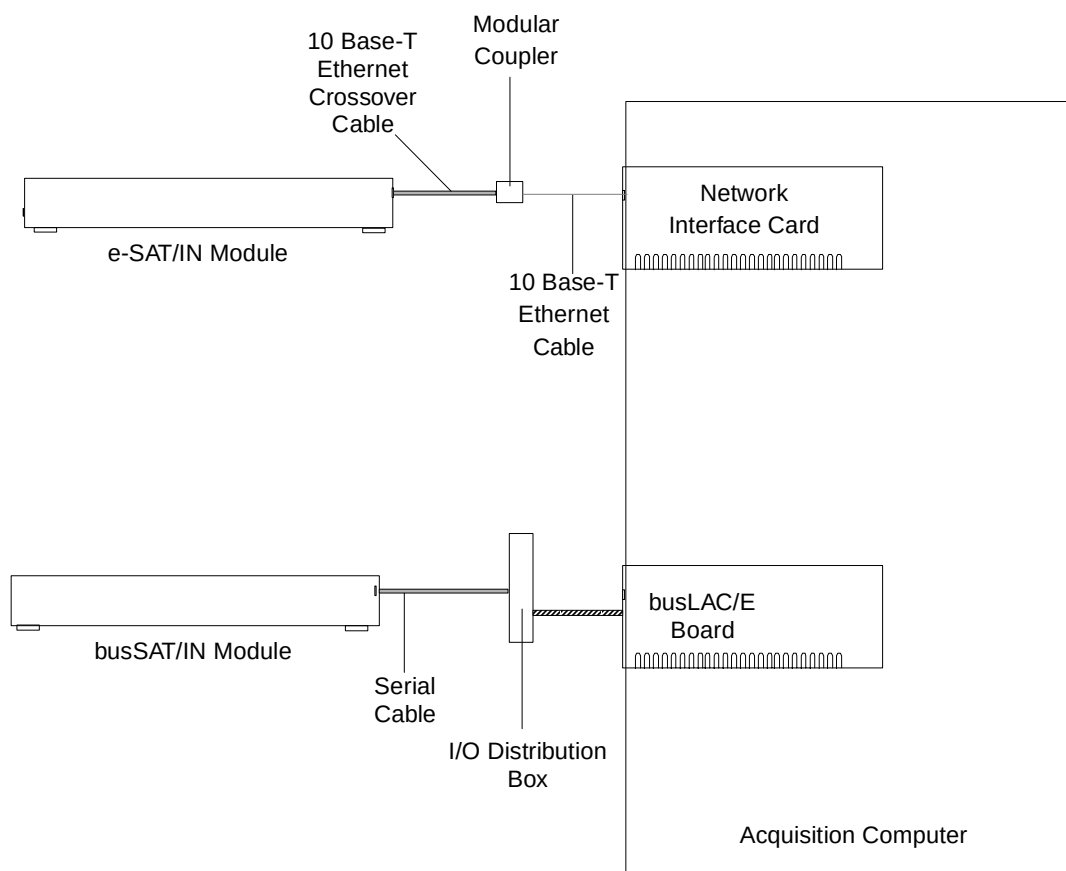


Figure 2-3 Integrated e-SAT/IN and busSAT/IN System

2.5 Connecting Analog Cables

Analog cables connect the detectors to the e-SAT/IN module. The front panel of the e-SAT/IN module provides a separate connector for the two analog input channels. Refer to the operating instructions supplied with the detector for specific connection details.

To connect analog cables:

1. Insert one end of an analog cable into the Channel 1 connector on the e-SAT/IN module. Refer to [Figure 2-4](#).

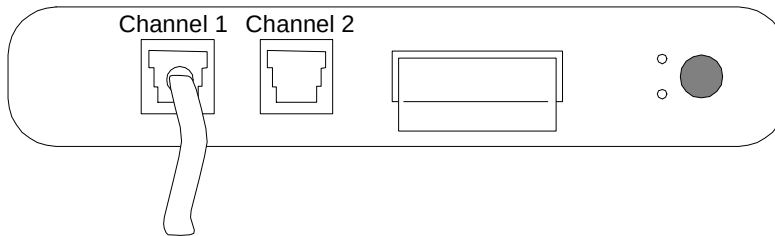


Figure 2-4 Analog Input Connections on the Front Panel

2. Connect the other end of the analog cable to the proper contacts on a detector (see the operator's guide for the detector). Note the positive (+) and negative (–) markers on the two wires. Connect both wires.

Place the detector up to 2 meters (6.6 feet) from the e-SAT/IN module (maximum analog cable length).

Note: The e-SAT/IN module signal input range is -0.25 to 2.25 V. Detector signals greater than 2.25 V produce a saturated signal.

3. To connect a second analog cable to the Channel 2 connector on the e-SAT/IN module, repeat steps 1 and 2.

2.6 Connecting Event Cables

Event cables transmit trigger signals between the e-SAT/IN module and the devices connected to the external event terminals. Refer to the operating instructions of the device you are controlling for specific connection details.



Attention: To meet the regulatory requirements of immunity from external electrical disturbances that may affect the performance of this instrument, do not use cables longer than 9.8 feet (3 meters) when you connect to the screw-type barrier terminal strips. In addition, ensure you always connect the shield of the cable to chassis ground at one instrument only.

2.6.1 Event In Connections

The e-SAT/IN module can accept either a TTL switch closure or pulsed inject start signal from a manual injector or autoinjector. The inject start signal triggers the e-SAT/IN module to start collecting and converting data.

2.6.2 Event Out Connections

The e-SAT/IN module can send event out signals to trigger external devices. Program event out signals using the Instrument Method Editor window. Refer to [“e-SAT/IN Events Tab” on page 45](#) for additional information.

2.6.3 Event In and Out Signal Assignments

Event In and Out signals correspond to the eight-position connector located on the front panel. [Table 2-1](#) shows the Event In and Out assignments.

Table 2-1 Event In and Out Signal Assignments

Position Number	Event Type	Label
1	OUT (+)	RELA
2	OUT (–)	
3	OUT (+)	TTL 1
4	OUT (–)	
5	OUT (+)	TTL 2
6	OUT (–)	
7	IN (+)	INJ START ^a
8	IN (–)	

a. Because both Channel 1 and 2 share the same timebase, both channels will be triggered at the same time.

To connect event cables:

1. Remove the event connector from the e-SAT/IN module.
2. Connect the two spade connectors at one end of an Event In/Out cable to:

- An injector, for an Event In signal (refer to [Table 2-1](#))
 - A device to be triggered, for an Event Out signal (refer to [Table 2-1](#))
3. Insert the two straight leads at the other end of the Event In/Out cable into the chosen assigned positions (refer to [Table 2-1](#)). Tighten the screws with a small flat-blade screwdriver ([Figure 2-5](#)).
 4. Reinstall the connector to the e-SAT/IN module.



Attention: Maintain correct polarity when connecting multiple instruments to Event In/Out terminals.

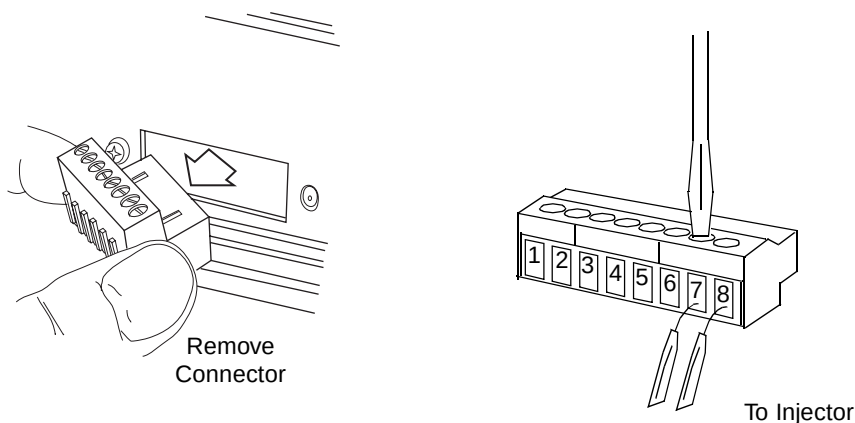


Figure 2-5 Event Connector Removal and Connections

2.7 Connecting the BCD Cable

The BCD (binary coded decimal) connection on the e-SAT/IN module allows the module to read and record BCD-encoded data from your controller instrument, such as an autosampler, that is compatible with the supported BCD data format listed in [Table 2-2](#). Refer to the controller instrument operator's guide for information about BCD formats. For information about using the BCD feature, see "Creating or Modifying an Instrument Method" in *Empower Help*.

The 9-pin BCD connection requires a compatible BCD cable. This cable is not provided with the e-SAT/IN module or other Waters instrumentation as standard equipment. BCD cables are usually available from the autosampler manufacturer. Refer to [Appendix B](#) for a Waters BCD cable accessory part number.

To connect the BCD cable:

1. Connect the BCD cable to the connector labeled BCD on the rear panel of the e-SAT/IN module ([Figure 2-6](#)).
2. Connect the other end of the cable to the BCD interface.

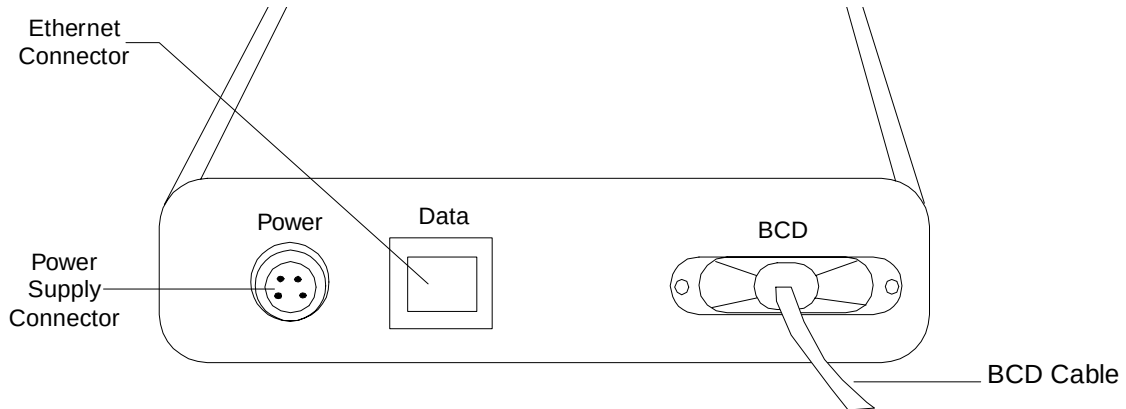


Figure 2-6 Connecting the Optional BCD Cable

[Table 2-2](#) lists BCD connection assignments and their binary values.

Table 2-2 BCD Connection Assignments

Pin	Value	Description
1	2^0	Least significant bit of least significant nibble
2	2^1	–
3	2^2	–
4	2^3	Most significant bit of least significant nibble
5	Ground	–
6	2^7	Most significant bit of most significant nibble
7	2^6	–
8	2^5	–
9	2^4	Least significant bit of most significant nibble

2.8 Connecting the Power Supply

To make the electrical connections for the e-SAT/IN module(s):

1. Ensure that the power switch on the front of each module is set to the **Off (0)** position.
2. Connect the power supply cable to the e-SAT/IN module before connecting it to the grounded AC source.
3. Connect the power supply to a properly grounded AC source. The power supply provided ([Figure 2-7](#)) specifically for the e-SAT/IN module is voltage autosensing, and will adjust accordingly within ratings listed on the device label. Ratings are in [Appendix A](#).



Attention: To avoid damaging the power supply cable, slide the DC power plug's plastic coupler backward when disconnecting the cable from the module. The power plug coupler contains a locking mechanism that must be unlatched before it can be disconnected.

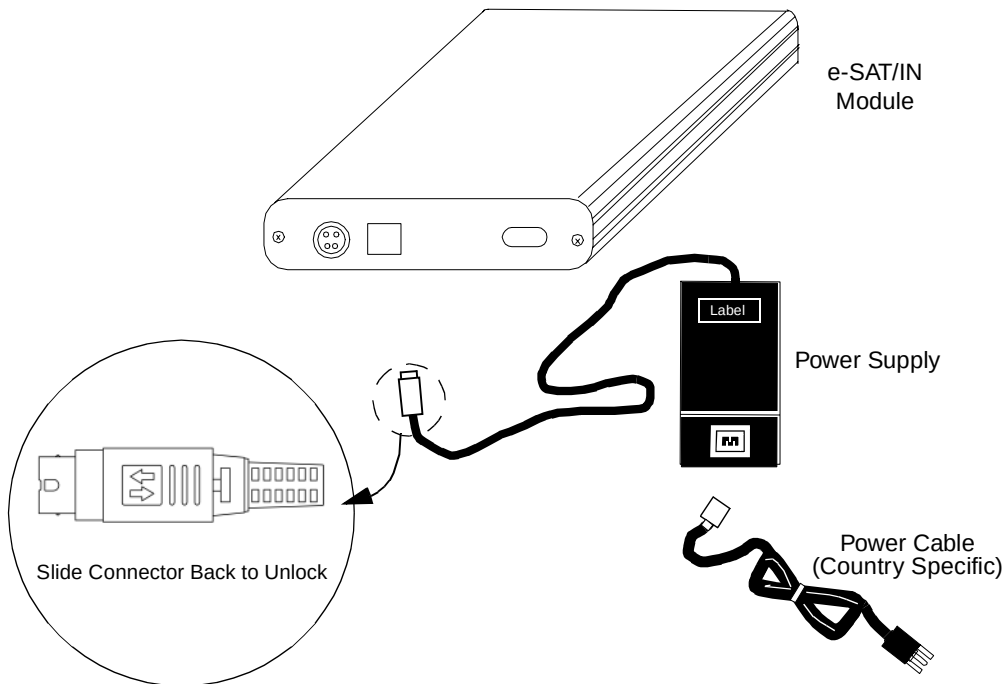


Figure 2-7 e-SAT/IN Module and Power Supply Kit

Chapter 3

Using the e-SAT/IN Module

This chapter describes the recommended power-on procedure for the e-SAT/IN module. It also discusses how to configure the e-SAT/IN module from Empower software, as well as how to troubleshoot the e-SAT/IN module.

Perform all procedures in the order specified in this chapter.

3.1 Powering On the Module

When all connections have been made, power on each detector connected to the e-SAT/IN module and any devices connected to the external event terminals. Refer to the specific guides for each device for power-on procedures.

The e-SAT/IN module has a power switch on the front panel. The switch is a pushbutton switch that controls the power from the power supply.

- To turn the device on (1 ) , press the switch once. The LED power indicator will light.
- To turn the device off (0 ) , press the switch once. The switch will return to the extracted position, switching off the power to the unit. The LED power indicator will extinguish.

3.1.1 e-SAT/IN Module Self-Tests

1. During power-on, the e-SAT/IN module performs a series of self-tests. The results of the tests are displayed by the green LED on the front panel.
2. After power-on, both LEDs flash.
3. The e-SAT/IN module executes a power-on self-test (POST).
4. The sequence then requests an IP address.
5. The green LED blinks while requesting its IP address. When an IP address is obtained, the LED becomes steady.

See [Table 3-1](#) for detailed information.

Successful Power-On

When the power-on and POST sequence are successful and the module has obtained an IP address, the green LED remains lit.

Power-On Problems

Refer to [Section 3.3, Troubleshooting](#), for information.

3.2 Configuring the e-SAT/IN Module

The e-SAT/IN module must be activated and configured on the acquisition computer that is presently running the acquisition software. The e-SAT/IN module is supported with Waters Empower software.

Before you can create a chromatography system and configure an instrument method, you should:

- Ensure that the e-SAT/IN module is connected properly to the chromatography system.
- Log in to the Empower application.

3.2.1 Creating a Chromatography System

You can create a chromatography system configuration at the acquisition computer.

You need to access the **Instruments** tab of the **Acquisition Server Properties** page of the **Configuration Manager**, and scan for instruments. Once the e-SAT/IN module is displayed and **Ok ?** is Yes, then a chromatography system can be created. After creating a system, you can set up or edit the instrument method. Refer to the *Empower Help* for details how to create a chromatography system.

When configured correctly, the e-SAT/IN module will be listed in the Available Instruments window in the New Chromatographic System Wizard, System Selection page.

3.2.2 Configuring Empower Software for the e-SAT/IN Module

Using the Instrument Method Editor, create or modify an instrument method for the e-SAT/IN module. Empower software has two modes of operation that contain the Instrument Method Editor:

- Empower Pro interface
- Empower QuickStart interface

Empower Pro Interface

To configure the e-SAT/IN module using the Instrument Method Editor in the Empower Pro interface:

1. Log in to Empower, then click **Browse Project**. The Browse Project dialog box opens as shown in [Figure 3-1](#).

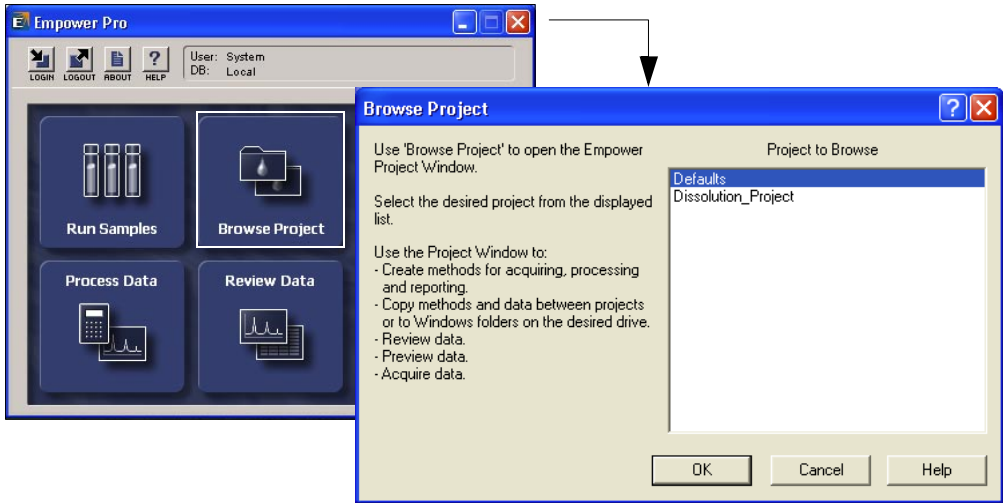


Figure 3-1 Empower Pro Window and Browse Project Dialog Box

2. Select a project, then click **OK**. The Project window opens.
3. Select **File > New Method > Instrument Method** ([Figure 3-2](#)).

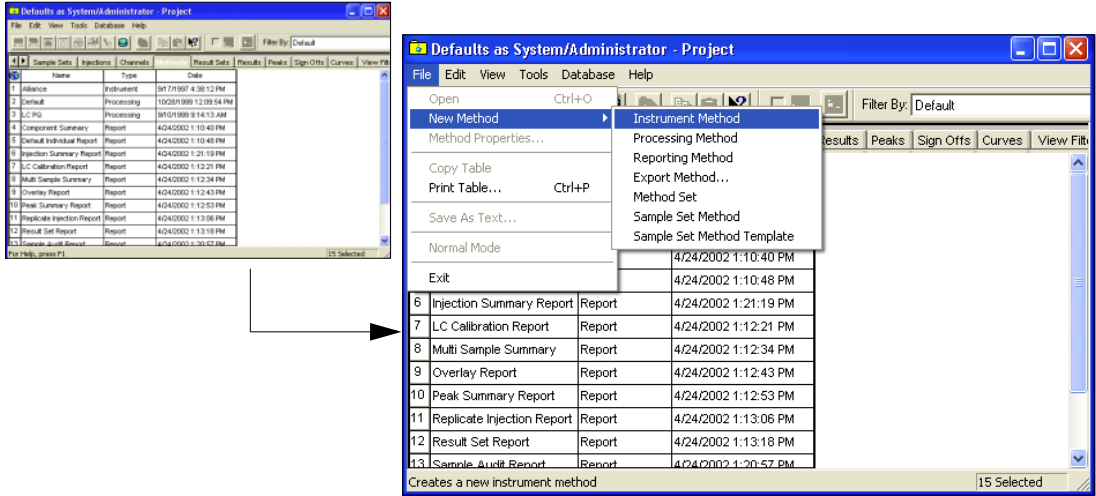


Figure 3-2 Active Instrument List

4. When an e-SAT/IN module is listed, you can modify the preferences using the Instrument Method Editor ([Figure 3-3](#)). When the e-SAT/IN module(s) is not listed, you can add a new instrument to designate the e-SAT/IN module as an active device.

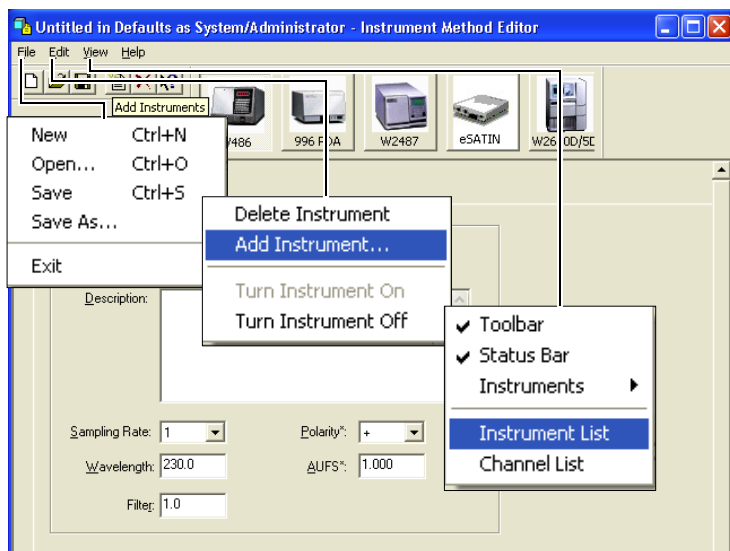


Figure 3-3 Instrument Method Editor

5. The Instrument Method Editor appears. This window has a selection of instrument icons located in the window taskbar. Click **e-SAT/IN**. The e-SAT/IN General tab appears ([Figure 3-4](#)).

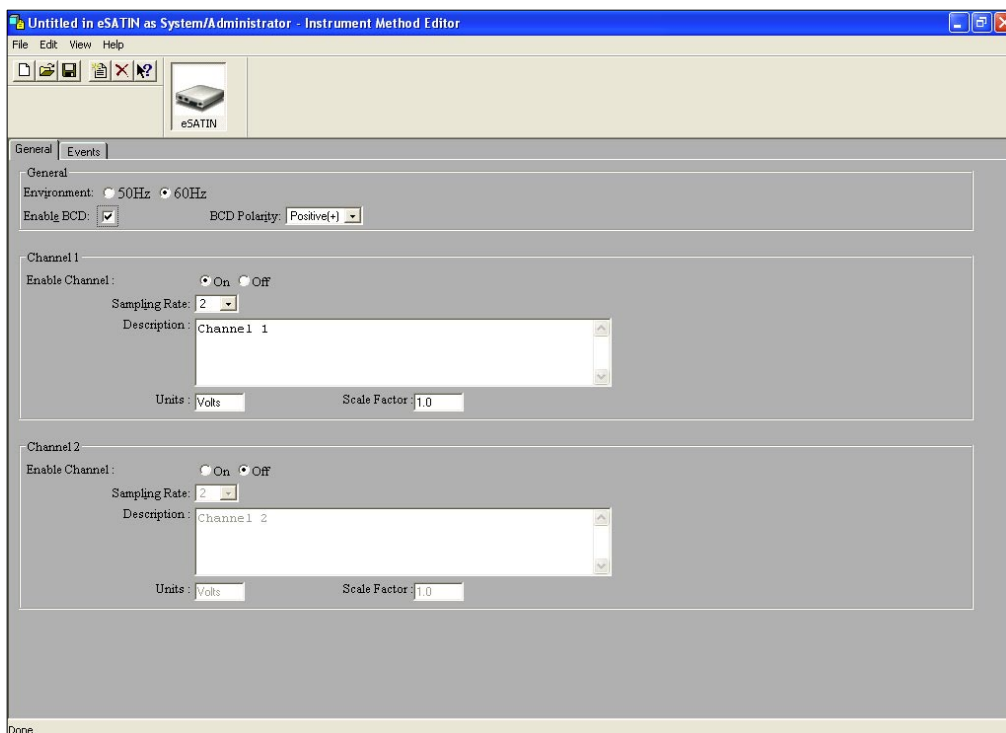


Figure 3-4 Instrument Method Editor, e-SAT/IN General Tab

e-SAT/IN General Tab

The General tab ([Figure 3-4](#)) contains specific preferences that affect the performance of the e-SAT/IN module. Refer to the “General Tab” topic in the *Empower Help*.

Selecting Sampling Rates

Quality data sampling relies on minimizing extraneous electrical noise in the environment. External devices near the e-SAT/IN module can influence baseline noise when the sample collection data rates are not optimized to the power line frequency (50 Hz or 60 Hz).

The General tab contains a selectable field for the power source line environment, allowing you to select sampling rates from a list of compatible sampling rates.

Note: The selected value does not affect the electrical power supplied to the instrument.

Users, depending on the frequency of their local power source, have the choice between:

- A method that is the same in all geographies, but which may have higher baseline noise in some areas
- A method that is optimized for low baseline noise in all geographies through the use of different sampling rates

The following sampling rates are available for a power line frequency setting of 50 Hz:

- 2, 5, 10, 12.5, 25, 50, 100, 200, and 400 samples per second

The following sampling rates are available for a power line frequency setting of 60 Hz:

- 2, 5, 10, 15, 30, 60, 120, 240, and 480 samples per second

Note: *The selected value does not affect the electrical power supplied to the instrument.*

Setting BCD Preferences

Enabling the BCD Input field allows for the capture of vial number information from autosamplers not controlled by Empower software.

To configure the e-SAT/IN module for BCD use:

1. Fill in the rows in the Samples table for the required number of injections.
2. Connect the e-SAT/IN module BCD port to the autosampler using a BCD cable. Ensure that the following conditions are defined for the e-SAT/IN module:
 - a. Specify the e-SAT/IN module as one of your instruments.
 - b. On the General tab, select the **Enable BCD** check box. This programs the e-SAT/IN module to read binary coded decimal values from the autosampler when the run time is completed. BCD information reflects the vial number of the injection.

Note: *When using a BCD protocol to capture vial number information from the autosampler, do not use 3-digit numbers, i.e., vial numbers greater than 99.*

Setting Units

Use the Units field to select the type of unit to appear on the y-axis of the chromatogram (for example, mV or AU). Units multiplied by Scale Factor equals 1 V. The maximum Units label length is six alphanumeric characters. The default is mV.

Setting the Scale Factor

Use the Scale Factor field to select the value that Empower software uses to adjust the display of the signal along the y-axis of the chromatogram. This value associates the Units parameter to volts (V). Scaling Factor multiplied by Units equals 1 V. For example, if you require AU on the y-axis and are using a detector where 1 AU equals 1 V, enter a scale factor of **1.0**. The default setting is 1000.

e-SAT/IN Events Tab

Use the Events tab to define operation and initiation of the selected e-SAT/IN module output events. Refer to [Figure 3-5](#).

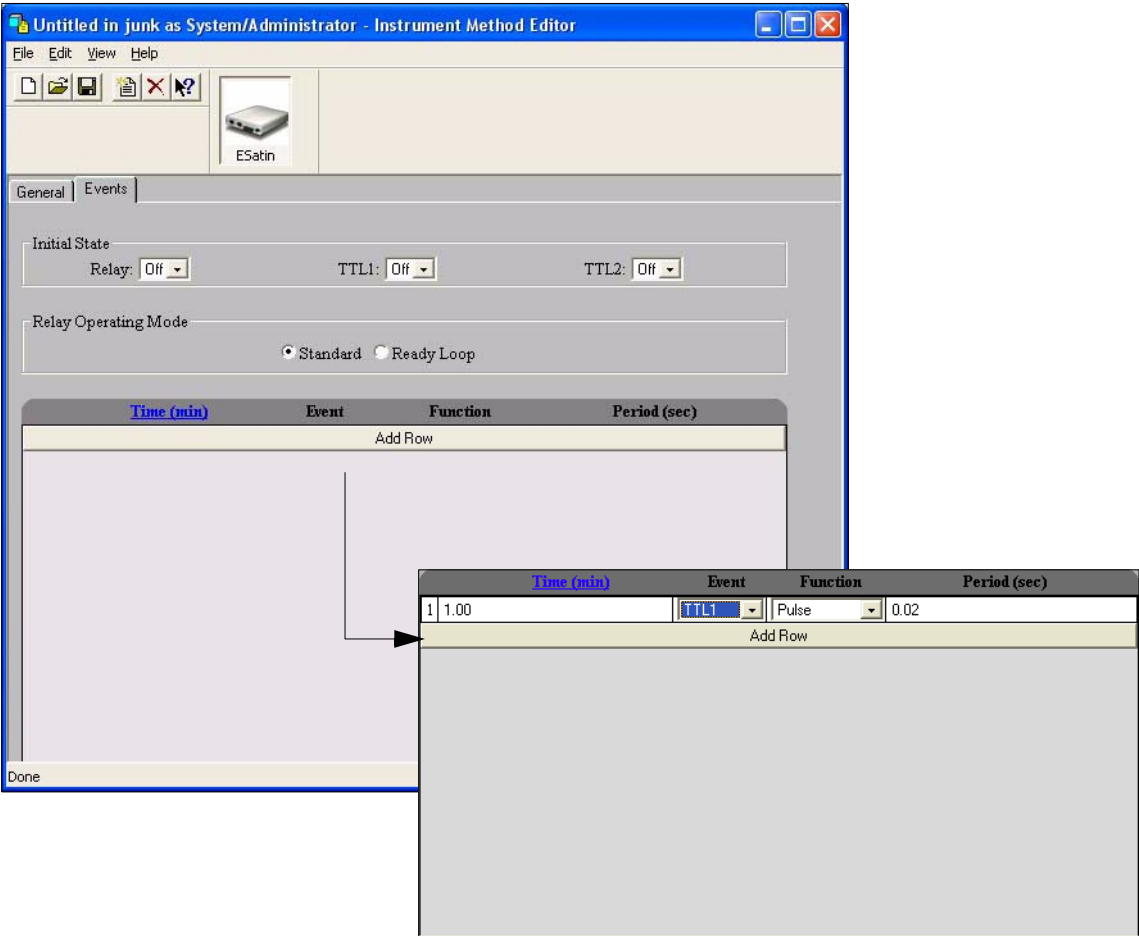


Figure 3-5 Instrument Method Editor, e-SAT/IN Events Tab

Enabling Events

Enabling an event output generates a contact closure that can initiate a process on another device (at a specified time after the e-SAT/IN event clock starts). The contact closure can control operation of a fraction collector or chart recorder, or activate solvent/column switching valves.

You can program event outputs in the Events table rows. In each row, specify the time that the event is to occur, the event function (On, Off, Pulse, or Repeat Pulse), and the duration of pulsed events.

Note: Event outputs do not provide power to run the external device. You must use an appropriate power supply to run the device.

Setting the Initial State

The Initial State area contains three fields that enable or disable the Relay, TTL1, and TTL2 contact closure of the e-SAT/IN module that communicates to other devices.

Select **On** or **Off** to enable or disable the function.

Setting the Relay Operating Mode

The purpose of a ready loop configuration is to prevent the autoinjector from making an injection when the rest of the chromatographic system (pump, detector, or data system) is not ready to run or collect data from the next sample.

In a ready loop configuration, devices (pump, detector, and data system) are wired in a series circuit with the autoinjector. When a sample is running, each device holds its ready loop event open. After the end of a run, the event is held open until the device is ready for the next injection; when each device is ready, it closes its own ready loop event. When all devices are ready and all ready loop events are closed, the autoinjector senses that the ready loop circuit is complete and proceeds with the next injection.

The Relay Event of the e-SAT/IN module can function as either a standard programmable event or as part of the ready loop, based on your selection in the Ready Operating Mode area. If Ready Loop is selected, no additional programming of the relay is needed in order to function in a ready loop architecture.

Entering Events Table Values

Enter values in these columns to program output events for instruments connected to the Event terminals on the e-SAT/IN module:

Time – When the event function occurs. Event rows are sorted by time. Entries: 0.00 to 650.00 minutes.

Event – Lists the event trigger mode selected in the Initial State area. Entries: Relay, TTL1, or TTL2.

Function – Contact closures are internally controlled by transistor-to-transistor (TTL) logic circuits, a class of digital logic. Generally speaking, these circuits operate on an average voltage range of $5 \pm 5\%$. A TTL signal is defined as “low” when 0 to 0.8 V with respect to ground, and considered “high” when greater than 3.5 V. The TTL is held high or Off in its normal state. When activated, the voltage is dropped low, switching the circuit to the On state.

Type of functions are as follows:

- **On** – Turns on a contact closure (relay switch). With this function, the event provides a Low position (low resistance) output that remains on until another function is sent.
- **Off** – Turns off the contact closure (relay switch). With this function, the event moves to the High position (high resistance), and the contact closure is broken.
- **Pulse** – Transmits one On/Off pulse. With this function, the event moves to the Low position, then to the High position. The contact closure (low resistance) is maintained for the pulse width specified by the Interval parameter. The default pulse width is 0.02 min.
- **Rep Pulse** – Transmits multiple On/Off pulses. The event alternates between the High and Low positions for the pulse width specified by the Interval parameter. Pulses continue until an Off function is sent.

Period – Duration of a pulse event in minutes. You can access this parameter only if you selected Pulse or Rep Pulse as the function. The minimum pulse width is 0.02 minutes On and 0.02 minutes Off. Entries: 0.02 to 100.00 minutes. Default: 0.02 minutes.

Comments – Optional description of the programmed event. The description can be up to 256 characters.

After the e-SAT/IN instrument method programming is completed and saved, you can run samples. Manually start the autosampler. Data acquisition begins automatically when Empower software receives an inject signal from the autosampler.

Using the Empower QuickStart Interface

To access the Instrument Method Editor using the Empower QuickStart interface:

1. Log in to Empower. Click **Advanced**, then select **QuickStart** from the Requested Interface list. The Select Project and System dialog box opens. Refer to [Figure 3-6](#).
2. Click **Use QuickStart** to initialize the QuickStart interface.

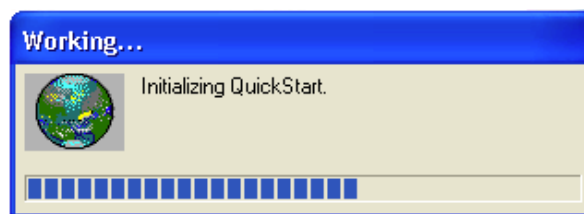
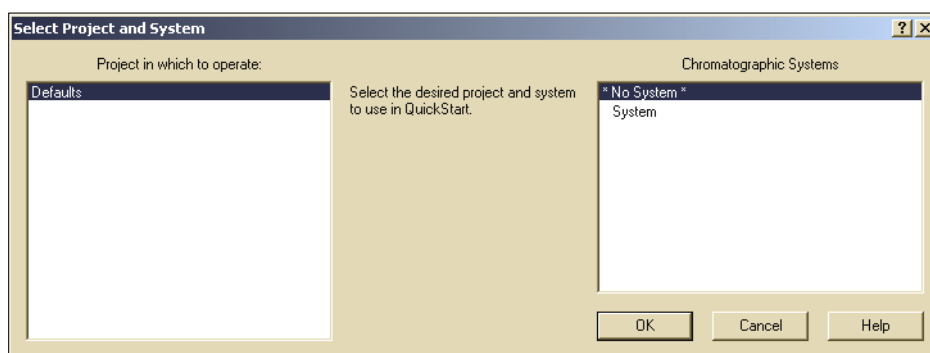


Figure 3-6 Accessing QuickStart

Empower QuickStart opens the Run Samples window ([Figure 3-7](#)).

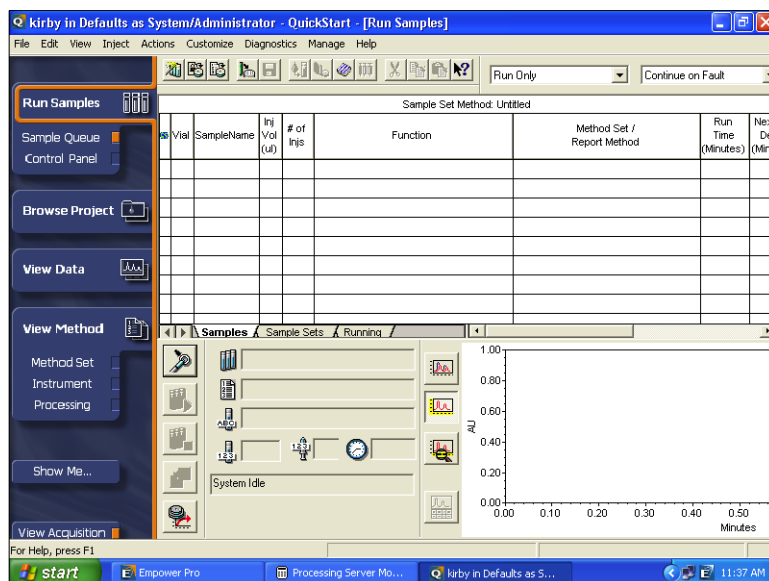


Figure 3-7 Run Samples Window

3. Access the instrument lists by selecting **View > Method > Instrument** ([Figure 3-8](#)).

Instrument
Selection
Control

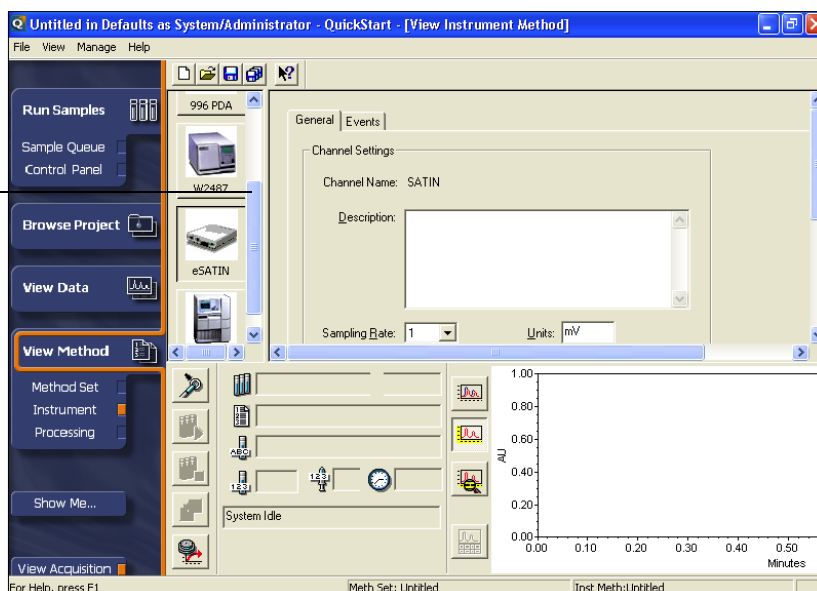


Figure 3-8 View Instrument Method Window

4. When an e-SAT/IN module is listed, you can modify the preferences using the Instrument Method Editor. When the e-SAT/IN module(s) is not listed, you can add a new instrument to activate the e-SAT/IN module as an active device.
5. The Instrument Method Editor appears. This window has a selection of instrument icons located in the window header. Click **e-SAT/IN**. The e-SAT/IN General tab appears ([Figure 3-9](#)).
6. See ["e-SAT/IN General Tab" on page 43](#) and ["e-SAT/IN Events Tab" on page 45](#) for full details.

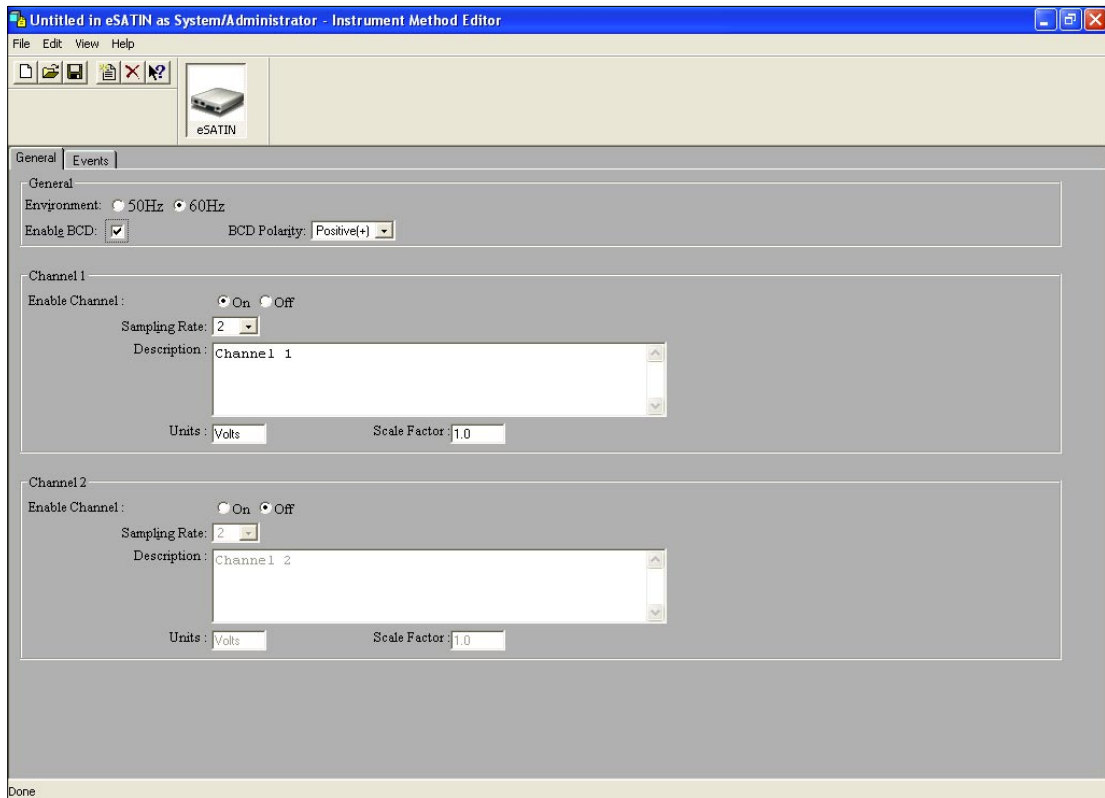


Figure 3-9 Instrument Method Editor, e-SAT/IN General Tab

3.2.3 Smoothing Noise in Empower

The smoothing feature in Empower decreases noise by using Savitsky-Golay filtering to average a defined number of data points. You create a derived channel to apply smoothing to data channel data.

To perform smoothing:

1. Access the Method Set Editor from the Project window, Run Samples, or Review.
2. Select an appropriate instrument method from the Instrument Method list.
3. Right-click the Method Set tree, then select **New > Derived Channels**. The First (Only) Channel tab of the Derived Channels dialog box appears.
4. In the First (Only) Channel tab:
 - a. Leave Constant at 1.000.
 - b. From the Channel list, select the channel to which you want to apply smoothing.
5. Click the **Filter/Offset** tab, then:
 - a. From the Smoothing list, select a smoothing factor. Available choices are None, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, or 31.
 - b. If appropriate, select a Derivative from the list.
 - c. If appropriate, enter an interdetector time offset (in minutes) in the RT Offset list.
 - d. If appropriate, enter start and end time parameters in the RT Offset/Scaling area.
6. After creating the derived channel, click **OK**, then name the channel. The Method Set Editor appears with the new derived channel in both the Method Set tree (under Derived Channels) and the Channel table.
7. Select an appropriate processing method for the derived channel.
8. Save changes to the method set, then exit the Method Set Editor.

Note: If the method set you are saving is locked, the Save command is unavailable. You must save your changes under a different method set name, using the Save As command.

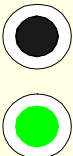
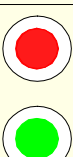
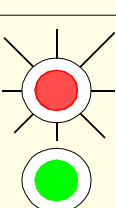
9. View the smoothing derived channel in Review, as follows:
 - a. In the Project window Injections Table view, select the sample or standard injection to which you want to apply smoothing.
 - b. Access **Review**.
 - c. Select **File > Open** to open the Method set.
 - d. From the 2D Channels table, click either sample or standard when you want to apply smoothing to the selected injection.
 - e. Select **Apply Method Set > Save** to view the smoothed channel.

10. Create a smoothed channel using Processing, as follows:
 - a. Select **Sample Set** or **Injection(s)**.
 - b. Select **Process**.
 - c. Select **Apply Method Set** and specify the name.

3.3 Troubleshooting

During power-on and operation, the e-SAT/IN module indicates its status using the LEDs on the front panel. Refer to [Table 3-1](#) for a summary of the LED indicators.

Table 3-1 Summary of LED Indicators

LED Indicator	Visual State	Meaning
	Data (amber) LED – Off Power (green) LED – Off	Power is Off, or the power-on test was unsuccessful.
	Data (amber) LED – Off Power (green) LED – On	Power is On. The power-on test sequence is successful, and the unit obtained an IP address.
	Data (amber) LED – On Power (green) LED – On	The device is On, ready for acquisition, and waiting for an injection to occur.
	Data (amber) LED – Blinking (at a 5-Hz cycle sampling rate) Power (green) LED – On	Data is being collected.

3.3.1 Power-On Problems

If the power LED does not light, check the following:

- Power supply is connected to a functional grounded AC voltage source.
- Power supply cable is properly attached to the e-SAT/IN module.
- e-SAT/IN module power switch is set to the on (1) position.

3.3.2 System Troubleshooting

Follow these basic steps to perform system troubleshooting:

1. Examine the system, checking the simple things first. Is something obvious causing the problem? For example, is an instrument unplugged or improperly connected?
2. Compare the current system operation with the way the system operated before the problem started. To help you identify normal operating conditions:
 - a. Create a map of your LC system (tubing and electrical connections).
 - b. Keep a daily log.
 - c. Run test chromatograms regularly.

Step b points out the importance of keeping track of system parameters and the results of your chromatography during normal operation. Troubleshooting is easier if you know the typical conditions when the system is operating correctly.

For example, if your system usually runs at n psi with a certain method, is the system pressure currently in the same range, or drastically higher (possibly caused by a plug) or lower (possibly caused by a leak)? Are pressure fluctuations in the same pressure range as during normal operation?

When your system is installed, and each time you develop a new method, record the system conditions during normal operation.

3. Identify in the following order the symptom that varies from normal system operation:
 - a. System pressure (high, low, or erratic)
 - b. Baseline (fluidic-path related or detector-electronics related)
 - c. Changes in peak retention time (incorrect or changing over time)
 - d. Loss of peak resolution
 - e. Abnormal peak shape (smaller than expected, broad, tailing, and so on)
 - f. Incorrect qualitative and/or quantitative results
4. Run the performance tests for each chromatographic instrument to quickly determine if a problem exists with a particular instrument.

If you determine that there is a problem related to another system component, refer to the appropriate operator's guide.

3.3.3 When to Call Waters Technical Service

Many problems with an e-SAT/IN module can be easily corrected. However, if you cannot correct a condition, contact Waters Technical Service at 800 252-4752, *U.S. and Canadian customers only*. Other customers, call your local Waters subsidiary or Technical Service Representative, or call Waters corporate headquarters in Milford, Massachusetts (U.S.A.).

When you call Waters Technical Service, have the following information available:

- Completed normal operation checklist for the method you are using
- Nature of the symptom
- Waters e-SAT/IN serial number
- Description of system configuration

3.3.4 Error Messages

Error messages related to the e-SAT/IN module ([Table 3-2](#)) will appear in the Empower Message Center Log. Click the Message Center icon in the taskbar to access the log.

Table 3-2 Error Messages

Error Number	Description
1	This occurs if the internal buffer in the e-SAT/IN module is filled.
2	This indicates an internal communication error in the e-SAT/IN module.
3	This indicates an internal hardware error in the e-SAT/IN module.
4	This error indicates that the e-SAT/IN module received an unknown command code.
5	This error indicates that there was a triggering related error.
6	An invalid length argument was specified in a command.
7	An invalid sample rate argument was specified in the Setup command.
8	An invalid environment argument was specified in the Setup command.
9	An invalid polarity argument was specified in the Setup command.
10	An invalid initial function argument was specified in the Setup command.
11	An invalid Output number argument was specified in one of the events in a Setup command.

Table 3-2 Error Messages (*Continued*)

Error Number	Description
12	An invalid event function argument was specified in one of the events in a Setup command.
13	An invalid Time argument was specified in one of the events in a Setup command.
14	An invalid period argument was specified in one of the events in a Setup command.
15	An invalid number of events argument was specified in the Setup command.
16	An invalid channel argument was specified in the Get Data command.
17	An invalid max points argument was specified in the Get Data command.

Appendix A

Specifications

This appendix includes specifications for the following:

- Physical ([Table A-1](#))
- Performance ([Table A-2](#))
- Analog input ([Table A-3](#))
- BCD input ([Table A-4](#))
- Power supply ([Table A-5](#))
- Communication interface ([Table A-6](#))

Table A-1 Physical Specifications

Item	Specification
Dimensions	Height = 1.25 inches (3.18 cm)
	Depth = 6.25 inches (15.9 cm)
	Width = 5.25 inches (13.3 cm)
Weight	530 grams (15.1 ounces)
Power switch	Front panel; pushbutton, On/Off
Power indicator	Green LED (constant when power is on)
Status indicator	Amber LED

Table A-2 Performance Specifications

Item	Specification
Analytical input range	−0.25 to 2.25 Volts
Total input range (no damage)	+/− 40.0 Volts (continuous)
Common mode voltage range	+/− 3.0 Volts
Common mode rejection ratio (60 Hz)	70 dB minimum
Input bandwidth	100 Hz
Power consumption	750 mW (typical)
Voltage accuracy	Output within 1% of input
Impedance (common mode)	500 K ohms, +/− 1%, minimum

Table A-2 Performance Specifications (*Continued*)

Item	Specification
Impedance (differential)	2 M ohm, +/- 1%, minimum
Nonlinearity	0.01% of full scale
Precision	+/- 0.1% for inputs greater than 0.5 mV
Difference in output	+/- 1% maximum
Unit-to-unit reproducibility	+/- 1% difference in outputs
Buffer capacity	225 Kb
Operating temperature range	4 to 40 °C (39.2 to 104 °F)
Operating humidity range	10 to 90%, noncondensing
Storage temperature range	-40 to 70 °C (-40 to 158 °F)
Storage humidity range	0 to 100%, noncondensing
Vibration and shock	Negligible

Table A-3 Analog Channel Performance Specifications

Sampling Rate, Samples per Second (Hz)	Noise ^a , microVolts (μV), Peak to Peak, Inputs Short Circuited
2, 5, 10, 12.5, 15, 25, 30	5
50, 60	12
100, 120	25
200, 240, 400, 480	50

a. Noise referred to input (RTI). Grounded inputs measured peak to peak (μV) at a 30-second interval.

Table A-4 BCD Performance Specifications

Item	Specification
Data format	Input = 8 bits, parallel
Electrical signal characteristics	TTL compatible, all 8 bits 1. V_{IH} = 2.0 Volts, maximum 2. V_{IL} = 0.8 Volts, minimum 3. I_{IH} = 20 μ A, maximum 4. I_I = 0.1 mA maximum 5. I_{IL} = - 0.1 mA typical (current out of module shown as negative)
Maximum input voltage	+/- 7 Volts
Flow control	None

Table A-5 Power Supply Specifications

Item	Specification
Input specifications	AC input voltage range = 90 to 264 Vac
	AC input frequency range = 47 to 63 Hz
	Input current = .38 A at 115 Vac, .15 A at 230 Vac
Output specifications	Output voltage = 5 Vdc at 4 A
	Output power = 22 to 24 Watts (typical)
	Overvoltage protection = Built in
Physical specifications	Height = 3.0 inches (7.6 cm) Depth = 5.0 inches (12.7 cm) Width = 1.0 inch (2.5 cm)

Table A-6 Communications Specifications

Item	Specification
Communications interface	Ethernet 10 Base-T

Appendix B

Spare Parts

This appendix lists recommended spare parts for the e-SAT/IN module. The e-SAT/IN module and power supply contain no internal user-serviceable parts. The e-SAT/IN module and a replacement is offered as an exchange stand-alone unit only.

Table B-1 Spare Parts

Item	Part Number
e-SAT/IN module (exchange stand-alone)	668000230
e-SAT/IN Startup Kit	200000167
e-SAT/IN to detector cable, 2 meters (6 feet)	WAT020320
Cable, event	WAT020321
Connector, event	323000336
Screwdriver, 3/32 inch	605000103
e-SAT/IN power supply	668000231
Crossover cable, 1 meter (3 feet)	440000145
Ethernet cable, 7 meters (22.9 feet)	WAT069054
Modular coupler, RJ45, straight wired	668000232
Network Switch Kit	668000162
BCD cable, 9 to 25 pin, D-series connectors	WAT611973
e-SAT/IN DIN Rail Mounting Kit	668000236
Waters e-SAT/IN Module Installation Guide (English)	71500049404
Waters Licenses, Warranties, and Support (multilingual)	71500029510
e-SAT/IN acquisition license	7166000984
Empower Software Instrument Driver Disk Kit	667001494

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