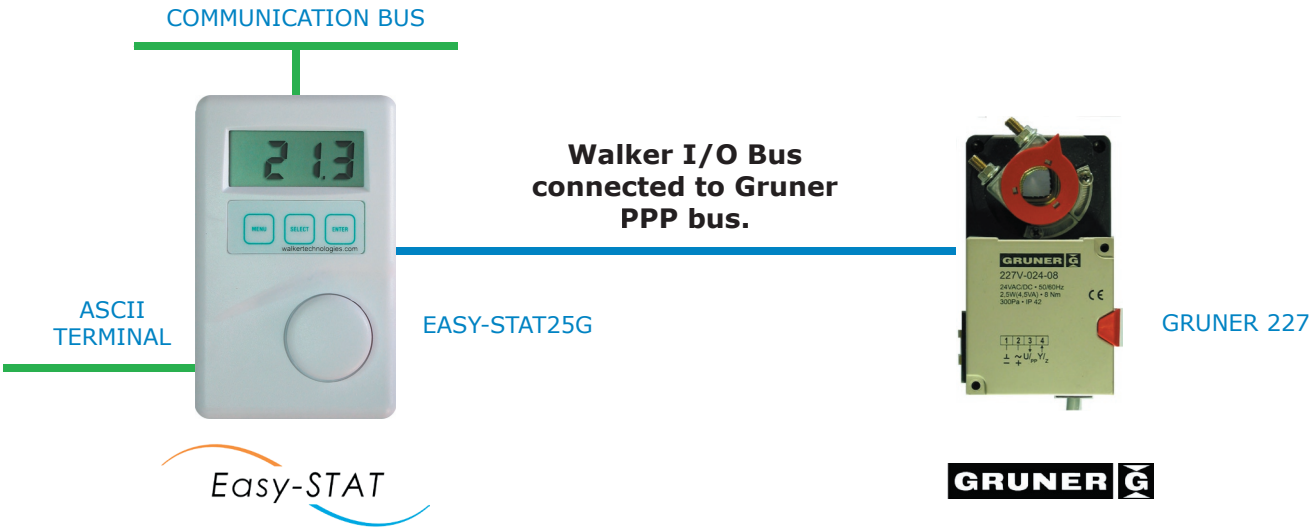

OPERATING VOLTAGE

- 24Vac (18Vac to 30Vac)
- Digital outputs – 20ma contact closure to ground
- Analog outputs – 0 or 2 to 10Vdc @ 20ma
- Output drive for 24/120/240 Volts through external relay board

SIGNAL INPUTS

- 0 to 5Vdc with 3.0K 1% pull up
- PP Bus from 227V

INTERNAL SENSOR

- 3K thermistor (+/- 0.2C, +/- 0.36F)

COMMUNICATION

- Jumper selectable Walker I/O BUS or RS232 (J4)
- MS/TP BACnet
- RS485 and I/O BUS available on the back of connector
- RS232 connector on the bottom of stat
- Connector at the bottom of stat allows for calibration of the Gruner 227V.

PREAMBLE

This discussion focuses on the setup and operation of Easy-STAT when tied to a Gruner flow controller. A prior knowledge of Easy-STAT operation is required.
Once the flow controller is connected to the Easy-STAT, the terminal display looks like figure 1 (pg.3). The items marked in BLUE are user Eprom presets that can be made via the download, keypad, or terminal entry. Please note that the information available in this discussion is for initial product setup and evaluation and is more than would normally be presented or required by a vendor. Reference documents and specifications on the Gruner motor and sensor are available from Walker.

FLOW MEASUREMENT AND "BOX FACTOR"

The Gruner flow sensor measures flow automatically and returns it to the Easy-STAT as a number 0 to 4063 in proportion of the flow that would result in 300pa or 1.204 inWC pressure differential at its flow pickup. By entering this maximum flow value in the Easy-STAT, the flow pickup is calibrated for the flow units used. The value of 300pa is a fairly common maximum pressure for a flow pickup device. For the Gruner sensor, returned values higher than 4063 indicat out of range pressures at the sensor pickup and are not accurate. For the flow equation, $V(flow) = C(factor) * (\Delta P(\text{sensor pressure})/p(\text{air density}))^{1/2}$, the Gruner motor does the square root extraction internally so that the output is proportional to the square root of the pressure change.
For the example shown on page 3, a Velocity Wing Air flow sensor made by Anemostat was used. It was determined from the flow sensor data that for a 6" duct, a flow of 832.5m^3/hr or 490cfm relates to this maximum pressure of 300pa.

USER DATA

To properly set up the Easy-STAT and Gruner flow controller, the user must enter the following 4 items (usually specified by the engineer):

FSEN Sensor flow: the flow value equivalent of the maximum sensor pressure. It is used to correctly scale the flow data returned from the sensor.
FDSN Design flow: the zone design flow specified by the engineer. It is used to normalize the motor operation over the intended range.
FMIN Minimum flow: the minimum flow required in the zone.
FMAX Maximum flow: the maximum flow required in the zone.

The Easy-STAT uses the design flow **"FDSN"** to tell the Gruner controller where the normal operating range of the flow control will be. The Easy-STAT then supplies the flow set point to the flow controller as a value proportional to this. The Easy-STAT converts the 0 to 100% controller output to a range between the **"FMIN"** and **"FMAX"** flow values and passes them to the motor as a flow set point. (Note: The Easy-STAT treats all values as dimensionless so that any flow units can be used.)

CALCULATIONS & MOTOR COMMUNICATIONS

To normalize the operation of the flow controller over the range desired, the Easy-STAT passes it a value corresponding to the ratio of the design flow **"FDSN"** to the maximum sensor flow (**"FSEN"+"FADJ"**). Here **"FADJ"** is the correction factor calculated as a result of balancing. The Easy-STAT shows this value,
"FNOM" = **"FDSN"/("FSEN"+"FADJ")** X 100% = 57.8.
For the Gruner motor, inputs must be normalized to 255, so this value is input to the motor by Easy-STAT as
"NORM" = (**"FNOM"**/100) X 255 = 147**.**

BALANCING PROCEDURE

To balance the VAV box where required (as in North America), you set up a flow of interest to yourself. For example, you can use the **"MOTR"** object to set the flow output to **"FMAX"**. Once this is done he sets the **"BALN"** variable to "ON" which puts the Easy-STAT in balance mode, then changes the value of **"BFLO"** to get the actual flow reading desired. During balance mode, the Easy-STAT back-calculates the flow reading to get an adjustment value **"FADJ"** as follows:

"FADJ" = **"BFLO"** * 4063/**"FRAW"** - **"FSEN"**

This value is then added to **"FSEN"** during normal operation

CONTROLLER OPERATION

The controller operates using a Proportional/Integral strategy that has a controller output **"CTLR"** that goes from 50% to 100% for cooling, and 50% to 0% for heating. Many options are available for driving additional outputs. This is described in the Easy-STAT controller manual.

Controller output and "FSET"

The output of the controller is converted so that the 50% to 100% output for cooling is converted to flow between **"FMIN"** and **"FMAX"**. This value must be presented to the motor in terms of **"NORM"** so:
SETPOINT(cfm) = (**"CTLR"** - 50.0)*2/100*(**"FMAX"**-**"FMIN"**)+**"FMIN"=38**
"FSET" = SETPOINT(cfm)/FDSN * 255 = 32

FLOW READING

For the flow output **"FRAW"**, the flow controller returns a number between 0 and 4063 for the flow between 0 and "FSEN". To convert this to cfm flow **"FLOW"**, the following calculation is used:
"FLOW" = (**"FSEN"**+**"FADJ"**) * **"FRAW"** / 4063.
370.6cfm = 518.2 * 2905/4063 .

SUPERVISORY CONTROL

All points shown in the example can be set for display or control by a supervisory system. Information on this is in the Easy-STAT and Walker product manuals.

MOTOR BACKUP

Both the Easy-STAT and the flow controller are set to store the relevant control parameters such as factor, design flow and min and max. When either device is replaced, it can be set to pick up the values from the other device.

Easy-STAT Objects

1 STCL 23.0 A	10 BISC 50.0 A L	19 FDSN 300.0 A
2 STHT 21.0 A	11 CTLR 55.0 A L	20 FMIN 20.0 A
3 NITE 15.0 A	12 ROOM 24.5 A L	21 FMAX 200.0 A
4 NITC 30.0 A	13 MINS 44 M	22 FSEN 490.0 A
5 PBNH 25.0 A	14 HOUR 8 M	23 FADJ 28.2 A L
6 RSTH .0 A	15 WDAY 1 M	24 FLOW 370.6 A L
7 PBNC 30.0 A	16 SCHN ON A	25 BFLO 370.6 M L
8 RSTC .0 A	17 SCHV ON A L	26 FNOM 57.8 A
9 BISH 50.0 A L	18 BALN OFF M	27 DISP 2 A

28 MOTR	2 A	Time	Controller State	Day or night operation	Temperature
29 MREV	OFF A				
30 DCDF	0 A	08:44:12	COOL	DAY_	24.5
31 HET1	OFF A				
32 HET2	OFF A				
33 OPER	ON A				
34 SEED	OFF A				
35 FMAX	OFF A				
36 LIMT	OFF A				

Gruner Flow Controller

Time schedule

DAY	ON	OFF
1	07:00	10:00
2	07:00	18:00
3	08:00	09:00
4	08:00	14:00
5	08:00	14:00
6	07:00	14:00
7	08:00	10:00

37 MSTS	130 A L	44 HRLO 0 A L
38 RMDE	2 A L	45 SEEP 3 A L
39 FSET	32 A L	46 DEDL 10 A L
40 NORM	147 A L	47 DEDH 10 A L
41 FRAW	2905 A L	48 GVER 118 A L
42 POSN	38 A L	49 WVER 2511 A
43 CTLL	2 A L	50 OEMK 0 A

0 40

C23.0 H21.0 20 2 352.8

FIGURE 1. Terminal capture from Version 2508

- Objects 1 through 36 are objects in the Easy-Stat database.
- Objects 9 through 12, 17, 23, 24, 26, and 31 through 36 cannot be modified by the operator.
- Objects 39 through 55 are information passed to and from the Gruner motor.
- Time schedule values can be modified by operator input or by supervisory control.

LEGEND

BLUE Operator presets - can be adjusted by operator.
PINK Values normally calculated by Easy-STAT.
RED Values written to Gruner Flow controller by Easy-STAT.
ORANGE Values read from external inputs and Motor.
GREY Preset system values - not to be modified.

EASY-STAT CONTROLLER VARIABLES

STCL Cooling set point
STHT Heating set point
NITE Night set point
NITC Night cooling set point
PBNH Proportional band for heating
RSTH Reset for heating (integral) in minutes/repeat
PBNC Proportional band for cooling
RSTC Reset for cooling (minutes/repeat)
BISH Bias for heating
BISC Bias for cooling
CTLR Controller output
ROOM Room temperature
MINS Minutes for time entry
HOUR Hour for time entry
WDAY Weekday for time entry
SCHN Master Schedule enable. If set to 0, schedule functions are disabled.
SCHV Current value of Schedule (On or Off)
BALN Off = normal mode, On = balancing mode
FDSN Design flow as specified by design and entered by operator
FMIN Minimum flow entered by operator (cfm)
FMAX Maximum flow entered by operator (cfm)
FSEN Maximum sensor flow entered by operator (cfm)
FADJ Flow adjustment to FSEN from balancing
FLOW Measured flow calculated from FRAW
BFLO Flow setup value entered by balancer
FNOM Percentage FDSN/(FSEN+FADJ)
DISP STAT display mode 0 - Temp, 1 - Time, 2 - Alternate
MOTR Motor control for balancing CLOSED, OPEN, AUTO, MAX and MIN.
MREV 0 = Motor normal, 1 = Motor reverse action
DCDF Display units 0 - DegC, 1 - DegF
HET1 First stage of heating
HET2 Second stage of heating
OPER ON/OFF - shows motor operation
SEED On -- Seepage flow detected
FMAX On -- Maximum sensor flow exceeded
LIMT On -- Motor is at limit stop

FLOW CONTROLLER VARIABLES

MSTS Motor status byte --- see Gruner documents.
RMDE Mode byte
FSET Flow set point from Easy-STAT
NORM Nominal or design flow as a ratio of FSEN
FRAW Flow output as a ratio of NORM
POSN Position feed back
CTLL Cycle count low word
HRLO Hours totalizer low
SEEP Seepage flow set point
DEDL Deadband Low
DEDH Deadband high
GVER Gruner motor firmware version
WVER Walker Easy-STAT firmware version

WALKER

- Easy-VAV -

Operator's Manual

Direct or terminal access for control

PC, LAPTOP OR PALM PILOT

RS232

Combined I/O boards (EXPD-series) mount on top of main board (connecting to both E3 and E4) to make compact packages for specialty or OEM applications.

WALKER I/O BUS

Proportional control of fan system and economizer

Easy-VAV full setup and control for Gruner Flow Controller/Motors

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