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Kump

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(54) **ACOUSTO-OPTIC TUNABLE FILTER CONTROLLER**

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Related U.S. Application Data

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(51) **Int. Cl.**
G02F 1/335 (2006.01)
H04J 14/00 (2006.01)

(52) **U.S. Cl.** **385/7**; 398/85

(58) **Field of Classification Search** .... None
See application file for complete search history.

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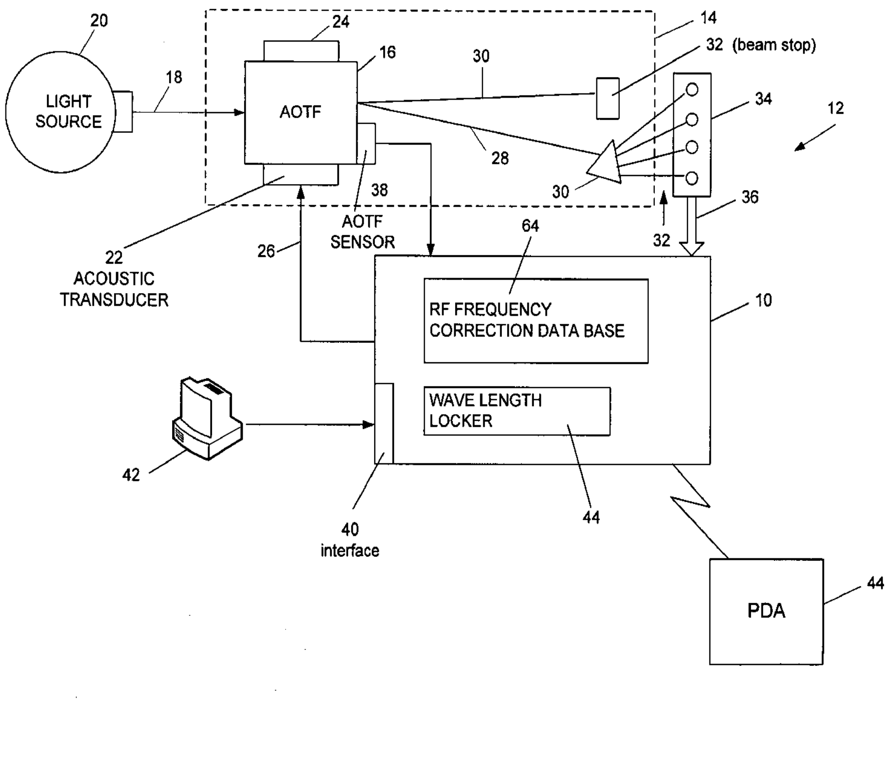
(57) **ABSTRACT**

AOTF controller that monitors output power of a plurality of wavelengths of an AOTF and scans the frequency of corresponding RF input signals to an AOTF acoustic transducer and searches for the RF frequency corresponding to each desired wavelength that provides maximum optical output for each wavelength. The controller includes a plurality of sensor inputs for monitoring the power of each wavelength output from the AOTF, and alternatively, also monitors other AOTF parameters such as temperature and/or reads AOTF identification performance data that can be stored in a EPROM on a AOTF housing. The controller includes facility for input of modulation data, and in response to the data modulates the corresponding wavelength parameter such as power. A USB bus is provided for input of programming to the controller, and for output of performance data from the controller.

18 Claims, 6 Drawing Sheets



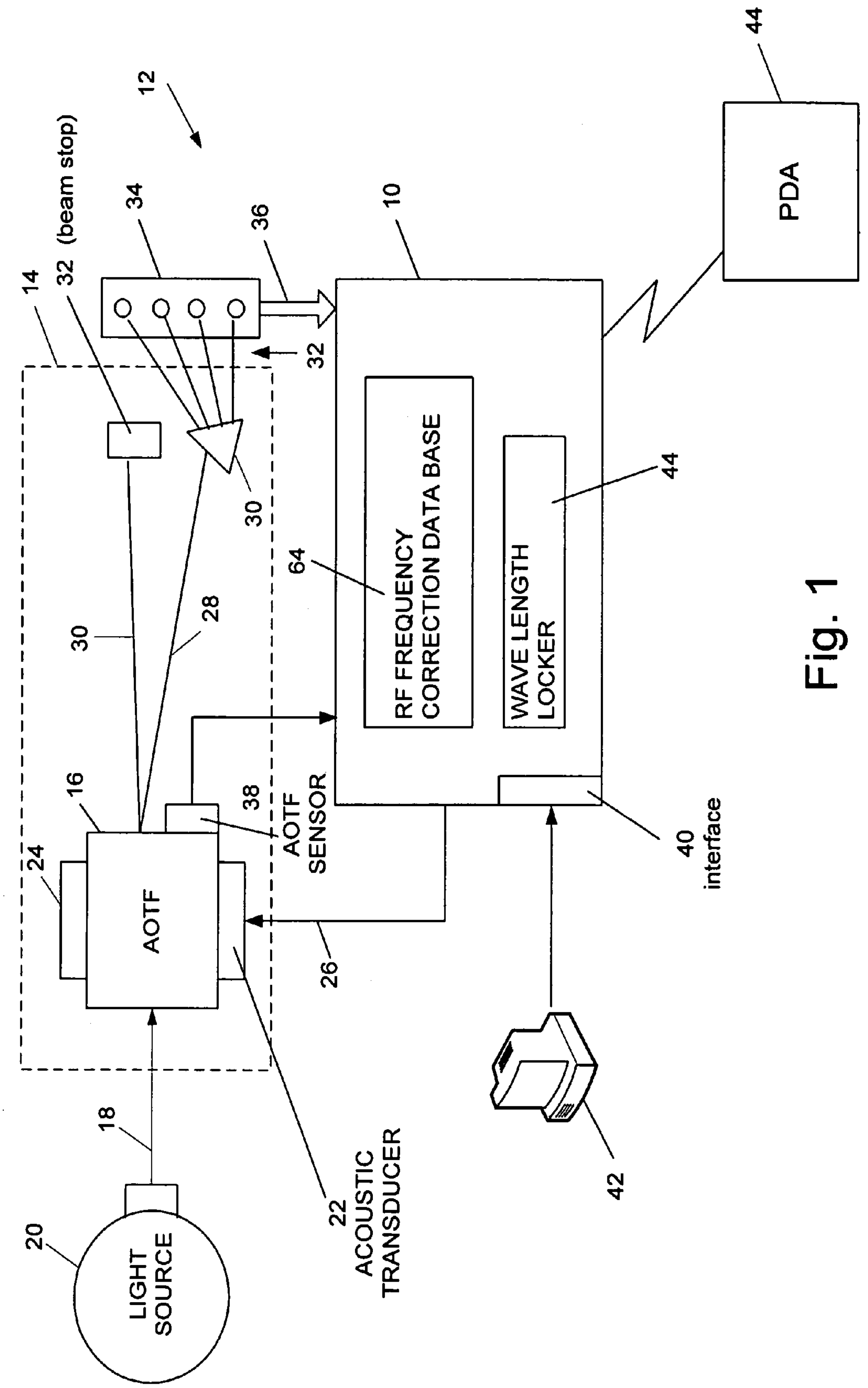

12
14
32 (beam stop)
34
36
32
30
30
28
10
PDA
44
RF FREQUENCY CORRECTION DATA BASE
64
WAVE LENGTH LOCKER
44
16
24
AOTF
38
AOTF SENSOR
26
40 interface
18
20
LIGHT SOURCE
22
ACOUSTIC TRANSDUCER
42

Fig. 1

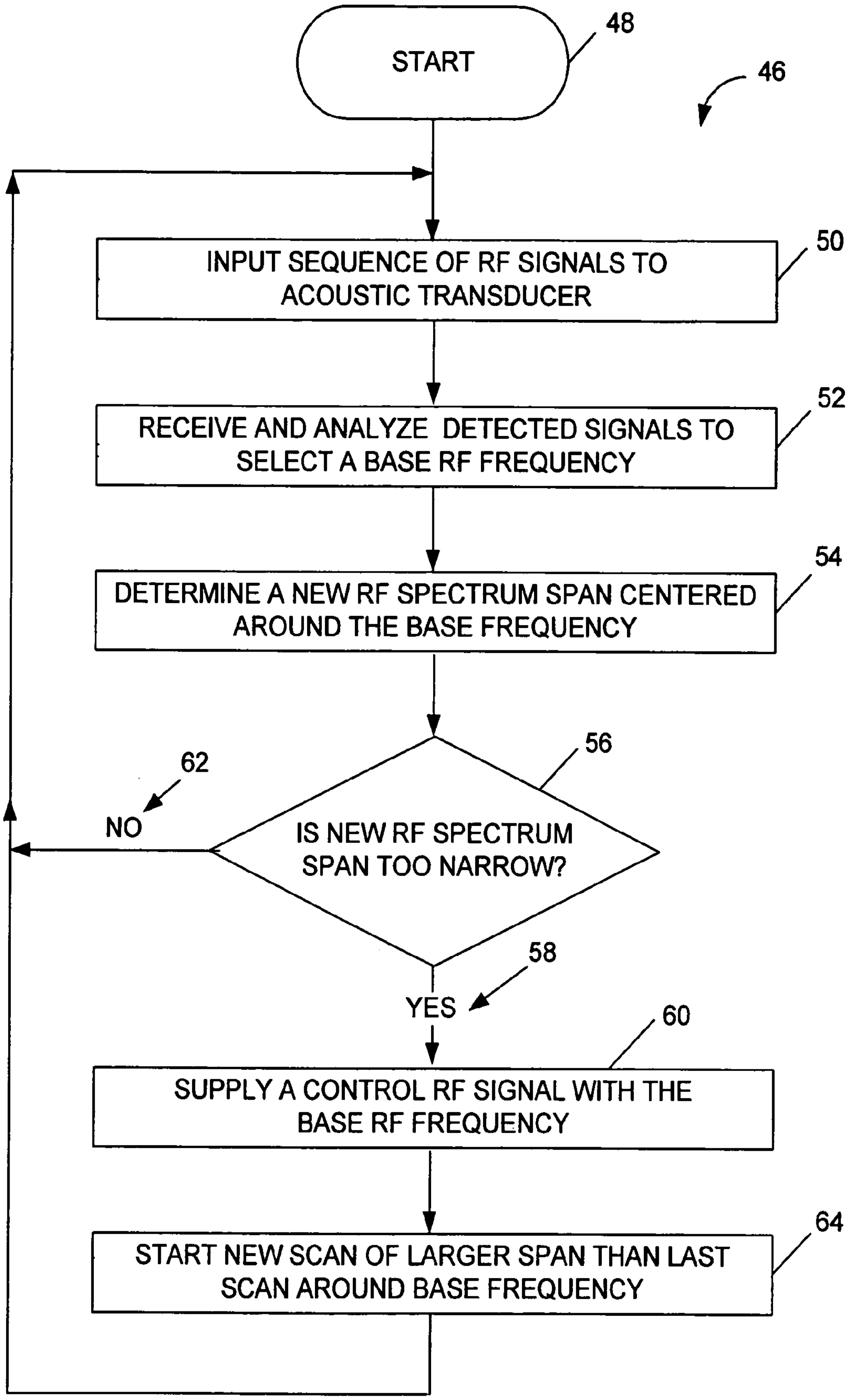

48
START
46
50
INPUT SEQUENCE OF RF SIGNALS TO ACOUSTIC TRANSDUCER
52
RECEIVE AND ANALYZE DETECTED SIGNALS TO SELECT A BASE RF FREQUENCY
54
DETERMINE A NEW RF SPECTRUM SPAN CENTERED AROUND THE BASE FREQUENCY
56
IS NEW RF SPECTRUM SPAN TOO NARROW?
62
NO
58
YES
60
SUPPLY A CONTROL RF SIGNAL WITH THE BASE RF FREQUENCY
64
START NEW SCAN OF LARGER SPAN THAN LAST SCAN AROUND BASE FREQUENCY

Fig. 2

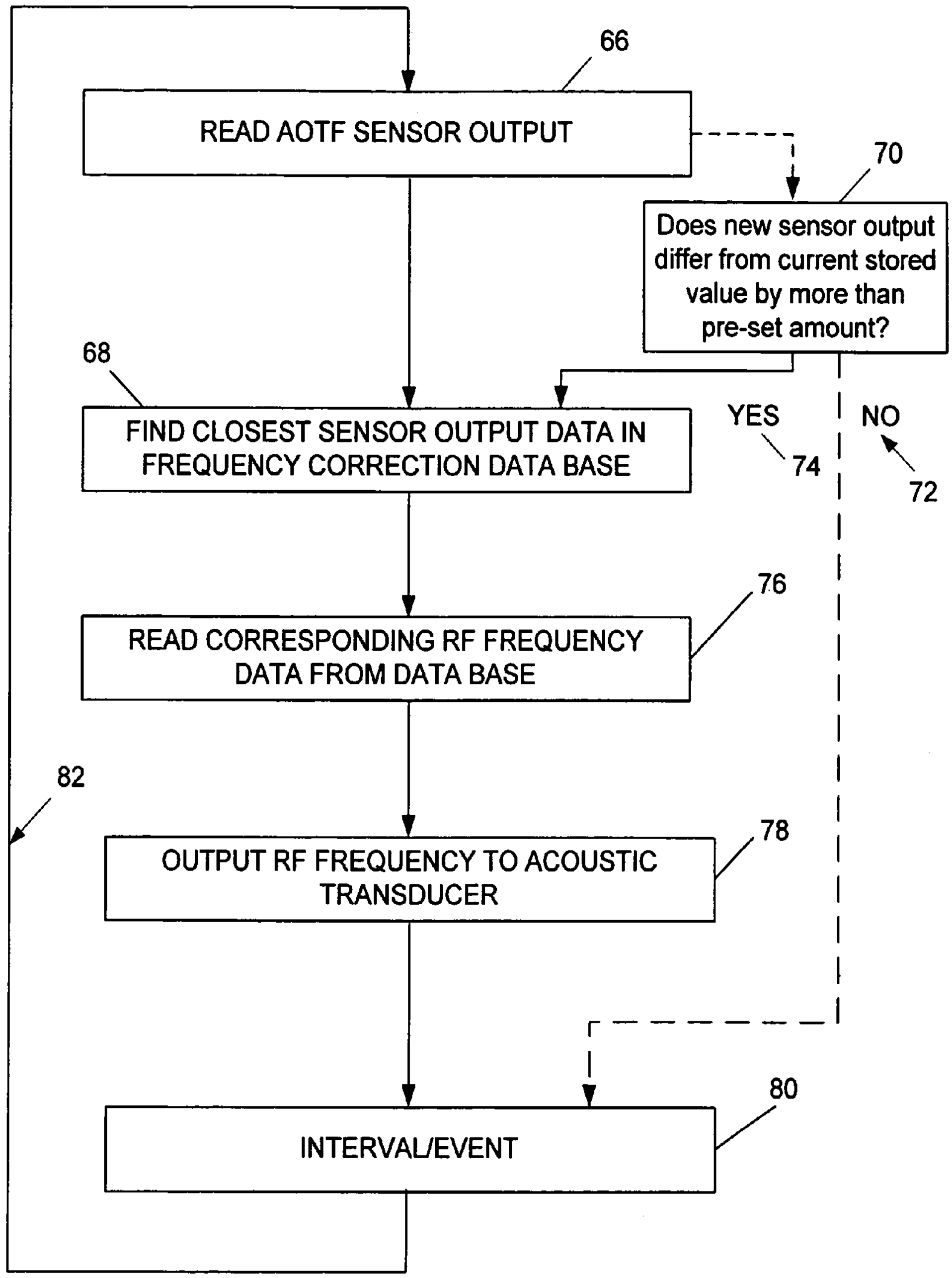

66
READ AOTF SENSOR OUTPUT
70
Does new sensor output differ from current stored value by more than pre-set amount?
68
FIND CLOSEST SENSOR OUTPUT DATA IN FREQUENCY CORRECTION DATA BASE
YES
74
NO
72
76
READ CORRESPONDING RF FREQUENCY DATA FROM DATA BASE
82
78
OUTPUT RF FREQUENCY TO ACOUSTIC TRANSDUCER
80
INTERVAL/EVENT

Fig. 3

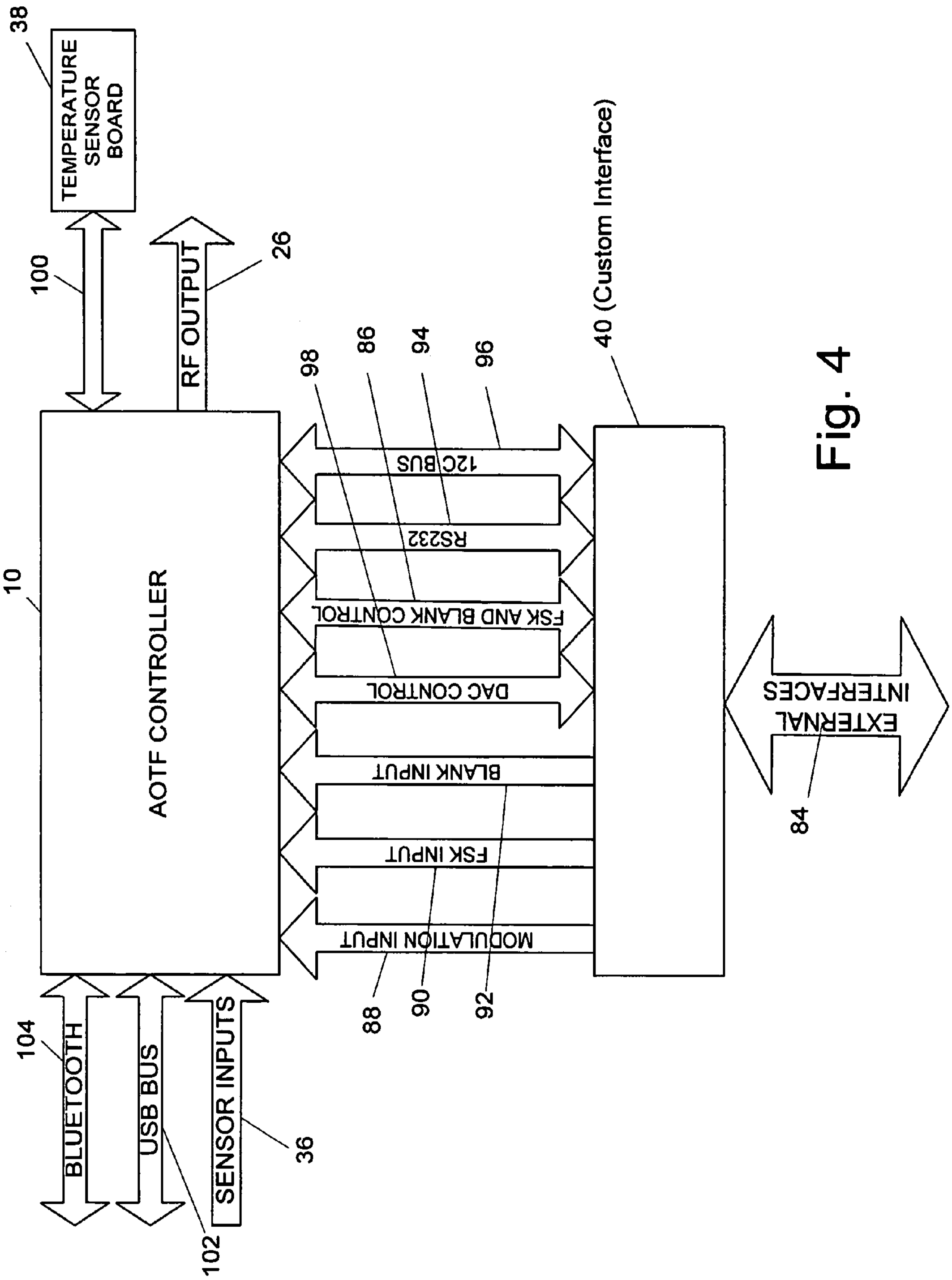

TEMPERATURE SENSOR BOARD
38
100
RF OUTPUT
26
10
AOTF CONTROLLER
40 (Custom Interface)
98
86
94
96
I2C BUS
RS232
FSK AND BLANK CONTROL
DAC CONTROL
BLANK INPUT
FSK INPUT
MODULATION INPUT
88
90
92
EXTERNAL INTERFACES
84
104
BLUETOOTH
USB BUS
102
SENSOR INPUTS
36

Fig. 4

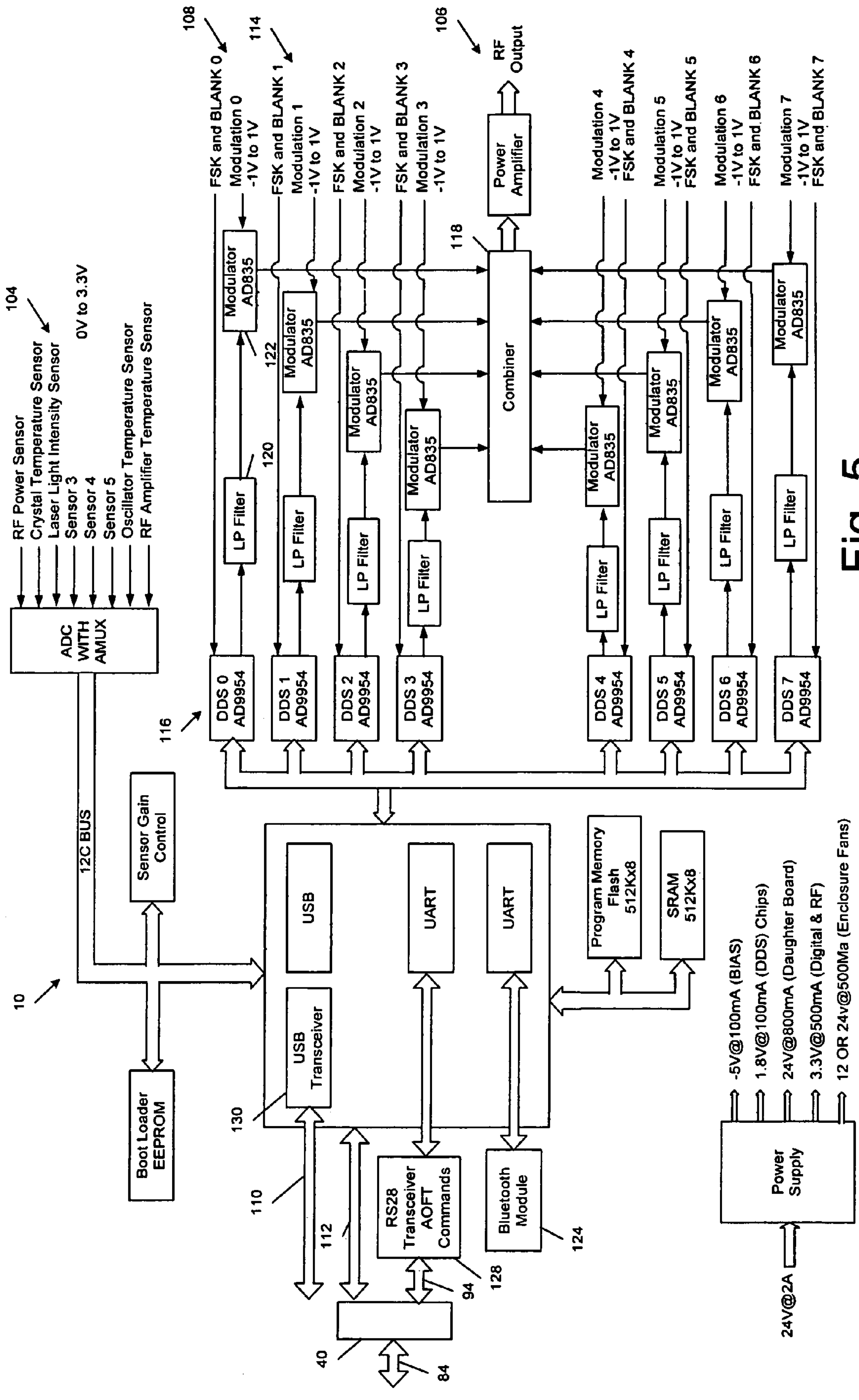

10
104
RF Power Sensor
Crystal Temperature Sensor
Laser Light Intensity Sensor
Sensor 3
Sensor 4
Sensor 5
Oscillator Temperature Sensor
RF Amplifier Temperature Sensor
0V to 3.3V
ADC WITH AMUX
12C BUS
Sensor Gain Control
Boot Loader EEPROM
108
114
106
FSK and BLANK 0
Modulation 0 -1V to 1V
FSK and BLANK 1
Modulation 1 -1V to 1V
FSK and BLANK 2
Modulation 2 -1V to 1V
FSK and BLANK 3
Modulation 3 -1V to 1V
RF Output
Power Amplifier
Modulation 4 -1V to 1V
FSK and BLANK 4
Modulation 5 -1V to 1V
FSK and BLANK 5
Modulation 6 -1V to 1V
FSK and BLANK 6
Modulation 7 -1V to 1V
FSK and BLANK 7
118
Combiner
Modulator AD835
122
120
LP Filter
116
DDS 0 AD9954
DDS 1 AD9954
DDS 2 AD9954
DDS 3 AD9954
DDS 4 AD9954
DDS 5 AD9954
DDS 6 AD9954
DDS 7 AD9954
USB
UART
UART
USB Transceiver
Program Memory Flash 512Kx8
SRAM 512Kx8
130
110
112
RS28 Transceiver AOFT Commands
Bluetooth Module
124
128
94
40
84
-5V@100mA (BIAS)
1.8V@100mA (DDS) Chips
24V@800mA (Daughter Board)
3.3V@500mA (Digital & RF)
12 OR 24v@500Ma (Enclosure Fans)
Power Supply
24V@2A

Fig. 5

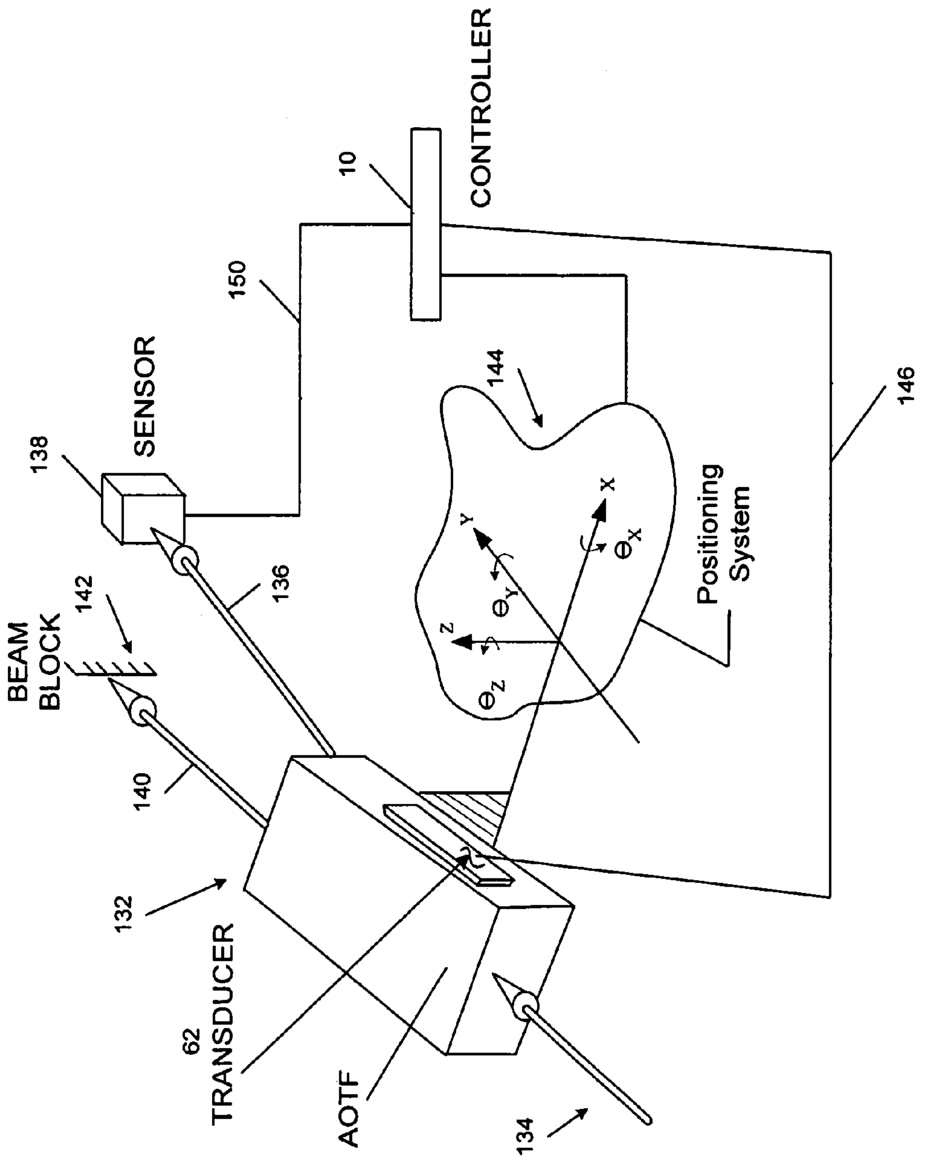

CONTROLLER
10
150
SENSOR
138
144
146
BEAM BLOCK
142
136
140
132
TRANSDUCER
62
AOTF
134
Positioning System
X
Y
Z
θ_X
θ_Y
θ_Z

Fig. 6

ACOUSTO-OPTIC TUNABLE FILTER CONTROLLER

This application claims the benefit of U.S. Provisional Application Ser. No. 60/564,891 filed Apr. 22, 2004, and U.S. Provisional Application Ser. No. 60/585,248 filed Jul. 1, 2004.

BACKGROUND OF THE INVENTION

1. Field of Invention

The present invention relates generally to control circuitry for optic filters, and more specifically to a control circuit for an acousto-optic tunable filter that automatically optimizes filter control parameters.

2. Description of the Prior Art

An acousto-optic tunable filter (AOTF) is used to select particular light wavelengths from an incident beam. Wavelength selection is needed in many areas of technology, such as fluorescence spectroscopy, microscopy, and optical communication systems. In addition to wavelength selection, AOTFs provide a means for light modulation of either or both wavelength and amplitude. AOTF performance is sensitive to various parameters including environmental temperature, acoustic power applied and combinations of frequencies, which can alter the AOTF crystal material properties and cause drift of output intensity. Due to this sensitivity, an AOTF crystal may be placed in a temperature controlled environment, which only partially stabilizes the crystal performance.

SUMMARY

It is an object of the present invention to provide an improved AOTF controller.

It is a further object of the present invention to provide an AOTF controller that automatically optimizes a specific wavelength filter output.

It is a still further object of the present invention to provide an AOTF controller that can be programmed for a variety of control functions.

It is another object of the present invention to provide an AOTF controller that provides performance output data for display.

It is another object of the present invention to provide an AOTF controller that can respond to various parameters for optimizing AOTF output.

Briefly, a preferred embodiment of the present invention includes an AOTF controller that monitors output power of a plurality of wavelengths of an AOTF and scans the frequency of corresponding RF input signals to. an AOTF acoustic transducer and searches for the RF frequency corresponding to each desired wavelength that provides maximum optical output for each wavelength. The controller includes a plurality of sensor inputs for monitoring the power of each wavelength output from the AOTF, and alternatively, also monitors other AOTF parameters such as temperature and/or reads AOTF identification performance data that can be stored in a EPROM on a AOTF housing. The controller includes facility for input of modulation data, and in response to the data modulates the corresponding wavelength parameter such as power. A USB bus is provided for input of programming to the controller, and for output of performance data from the controller.

IN THE DRAWING

FIG. **1** illustrates an acousto-optic-tunable filter controller according to the present invention interconnected in a system;

FIG. **2** is a flow chart for describing wavelength control as performed by the controller;

FIG. **3** is a flow chart illustrating the controller operating to correct wavelength variations due to environmental conditions;

FIG. **4** is a block diagram for describing various inputs and outputs of the controller, and for describing a controller interface apparatus;

FIG. **5** is a more detailed block diagram of the controller and interface apparatus; and

FIG. **6** illustrates use of a controller for maintaining an optimum position of an acousto-optic-tunable filter.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of the method and apparatus of the present invention will now be described in reference to FIG. **1** of the drawing. An acousto-optic-tunable filter controller (AOTF) **10** according to the present invention is shown in operation in a system **12** for controlling light output from an acousto-optic-tunable filter **14**. A typical acousto-optic-tunable filter **14** includes an AOTF crystal **16** (e.g., a tellurium dioxide, quartz, and so on). An incident beam of light **18** (also referred to as an optical input signal) from a source **20** impinges on the AOTF crystal **16**. A typical AOTF **14** further includes an acoustic transducer **22** bonded to one side of the AOTF crystal **16** and an acoustic absorber **24** bonded to the opposite side of the AOTF crystal **16**. Acoustic waves are generated by the acoustic transducer **22** in response to an input RF signal **26**. The frequency of the acoustic waves depend on the frequency of the applied RF signal, and the waves propagate through the AOTF crystal **16** and get absorbed in the acoustic absorber **24**. The acoustic waves that propagate through the AOTF crystal **16** can generate a diffraction grating within the AOTF crystal such that a substantial portion of the incident beam of light **18** is diffracted. As a result, an output **28** of a typical acousto-optic-tunable filter includes a diffracted beam **28** that, for example, can be used as input to another optical device and an undiffracted beam **30** that is absorbed by a beam stop **32**.

In addition, the diffracted beam **28** (also referred to as the optical output signal) is a "filtered" version of the incident beam **18**. That is, the optical output signal **28** includes only a subset of wavelengths (i.e., "selected" wavelengths) that are present in the optical input signal **18**.

Wavelength selection is controlled by the frequencies of the acoustic waves that are generated by the acoustic transducer **22** bonded to the AOTF crystal **16**. That is, a selected wavelength of the optical output signal **28** depends on the acoustic frequency of an acoustic wave generated by the acoustic transducer **22**. Moreover, the frequency of an acoustic wave generated by the acoustic transducer **22** is controlled by the control RF signal **26** supplied to the acoustic. transducer **22**. That is, an acoustic frequency of an acoustic wave generated by the acoustic transducer **22** (which substantially determines a selected wavelength of the optical output signal **28**) is substantially determined by the base RF frequency of the control RF signal **26** supplied to the acoustic transducer **22**. Consequently, a selected wavelength of the optical output signal **28** is "tuned" by the base RF frequency of the control RF signal **26**.

The output **28** contains a spectrum, which can be further separated by any known device for the purpose, such as a prism **30**. The output wavelengths **32** are detected by a detector/sensor **34** which provides input **36** to the controller **10** of the present invention. The controller functions to provide what will be referred to as a wavelength locker **44** (FIG. **1**), wherein a series of RF input scans are applied at **26** to the AOTF transducer **22**, with each consecutive scan of reduced span. The controller responds to the resultant outputs **36**, selecting the best frequency of each scan to determine the center of the next narrower scan to determine an optimum RF frequency (base frequency) **26** to drive the AOTF for achieving the desired AOTF output signals **32**. This function will be more fully described in reference to FIG. **2**.

According to a further embodiment of the present invention the controller **10** is configured to receive data from an AOTF sensor **38** for sensing a condition of the AOTF such as an AOTF temperature. The controller **10** is configured to respond to the sensor **38** output by adjusting the RF signal at **26** to provide an optimum output at **32**. This operation will be fully described in reference to FIG. **3**.

According to a still further embodiment of the present invention, the controller provides an interface **40** providing convenient communication apparatus to a computer **42**, and alternatively or in addition to a personal digital assistant (PDA) **44**. These and other features of the interface **40** will be fully described in reference to FIG. **4**.

The wavelength locking feature will now be described in detail in reference to the flow chart of FIG. **2**. The wavelength locker **44** determines a base RF frequency for the control RF signal **26** needed to substantially maintain an optical output signal at **32** at a desired wavelength. Referring to FIG. **2**, the wavelength locking process **46** can be initiated (**48**) in a variety of ways. The process can be initiated by an end user (e.g., a technician) of the AOTF controller **10** through a user interface to the AOTF controller **10** (e.g., using the computer **42** connected to the AOTF controller **10** through a USB port, or through an RS232 port. Alternative, the AOTF controller **10** can be configured to initiate the process for determining the base RF frequency for the control RF signal at **26** at a predetermined time (e.g., on power up). Moreover, the AOTF controller **10** can be configured to initiate the process **46** at regular intervals.

Once the process **46** for determining the base RF frequency for the control RF signal **26** is initiated (**48**) in the wavelength locker **44**, the wavelength locker **44** inputs (scans) a sequence of RF signals into the acoustic transducer **22** (block **50**), and then receives an output detected signal **32** through bus **36** (block **52**). The controller evaluates the detected data to determine which data is closest to the desired result, and then uses the corresponding applied RF signal as a new base RF frequency (block **52**) for the next scan. The controller then determines a new sequence of RF frequencies centered around the new base frequency, wherein the new sequence is a reduced RF spectrum span from the preceding spectrum span (block **54**). The controller then checks to determine if the new span is less than a pre-determined minimum (block **56**). If it is less **58**, then the base frequency of the new span is used to drive the acoustic transducer **22** (block **60**). If the new span is greater than the minimum **62**, then the process repeats wherein the new span/sequence is applied (block **50**) and the resultant detected signals are analyzed (block **52**), etc. This process will now be described in still more detail.

The scanning process of FIG. **2** includes repetitions of steps for automatically adjusting the controller RF drive to the AOTF for optimizing optical power output from the AOTF. A range of RF frequencies is set to be applied to the AOTF acoustic transducer, which most generally can be from any lower frequency (F_{low}) to any higher frequency (F_{high}). The spectrum is divided (F_{low} to F_{high}) into a sequence, for example of 1000 equal increments, or more generally "n" increments. The n+1 frequencies (sequence) are then sequentially applied (scanned) and the sensor output read for each point. A smaller scanning range is then selected by dividing the previous frequency spectrum span by some number (for example by 4). The center for this more narrow scan is selected as the frequency yielding the highest output (detected output) resulting from the previous scan just completed. Then the new sequence of RF signals is applied to the acoustic transducer **22**, etc. This process is continued until the frequency spectrum span is less than 100 Hz or other selected value. The RF frequency yielding the largest AOTF output is then used as the center/base RF frequency for driving the acoustic transducer of the AOTF.

As a further embodiment, because the optimum RF frequency may change with time due to a variety of factors, such as temperature, at some pre-determined interval of time or event, a new scan can be initiated (block **64**). The center RF frequency for this new scan can be the previously determined base RF frequency. The span of the frequencies is selected to be large, as done initially, to be certain that the span includes the best RF frequency. Each succeeding scan is then narrowed until a new base frequency is determined.

The controller can additionally be configured to provide output to a computer **42** (FIG. **1**) for display of a chart/graph showing the optimum RF frequency **26** as a function of a desired wavelength output at **32**. This data can be arrived at by systematically stepping the temperature, and for each temperature, performing the wavelength locker process as described in reference to FIG. **2**.

In a further embodiment of the present invention, the controller senses an output of the AOTF sensor **38** and in response makes an adjustment of the RF frequency at **26** to optimize the output of **32**. One embodiment of this feature requires a pre-calibration of the controller **10**, for example by setting the AOTF sequentially at various temperatures, and determining the optimum RF signal frequency for a particular wavelength at each temperature. This data of RF frequency vs. temperature for each of a plurality of selected wavelengths, can be stored in an RF frequency correction data base **64** (FIG. **1**). The process of using this data in operation of the system is illustrated in reference to FIG. **3**. The controller begins by reading the AOTF sensor output (block **66**). The controller then finds the closest sensor output data in the frequency correction data base (block **68**). Alternatively, block **70** can be included, wherein the controller **10** stores a last/previous sensor data and compares the new data with the previous data. If the new data does not differ by more than a pre-set amount **72**, the process skips to block **80** and the controller waits for a pre-set time interval or other event before repeating the process as indicated by line **32**. If the new data does differ by at least the pre-set amount **74**, then the controller finds the closest sensor output data in the frequency correction. data base (block **68**) and selects the corresponding RF frequency data from the database to apply to the acoustic transducer (block **76**). Then the controller outputs the RF frequency to the acoustic transducer (block **78**). At this point, the controller can wait for an interval, such as a pre-set time period, or until the controller receives a command to repeat the process (block **80**).

FIG. **4** illustrates various alternative communication features of the present invention, including the use of a custom interface apparatus **40** (FIG. **1**). The interface **40** includes an input-output bus **84** for input of analog and/or digital modulation, for FSK (frequency shift keying) and blanking control inputs, and RS232 communications. A corresponding FSK and blanking communication bus **86** between the controller **10** and interface **40** is provided. The interface **40** may provide modulation **88**, FSK **90** and blanking **92** inputs to the controller. RS232 and 12C buses **94** and **96** between the controller **10** and interface **40** are included, as well as a DAC bus **98**. FIG. **4** also shows the AOTF sensor **38** and a bus **100** interconnected to the controller. Bus **26** provides the RF signal to the AOTF acoustic transducer **22**. Sensor input bus **36** brings the wavelength detected signals to the controller. A USB bus **102** and blue tooth bus **104** are also provided. Further details concerning these features are described in U.S. Provisional, Patent application No. 60/585,248 file Jul. 1, 2004, the entire contents of which is included in the present disclosure by reference.

An embodiment of an acousto-optic-tunable filter (AOTF) controller **10** of the present invention is shown in more detail in FIG. **5**. The controller **10** has a plurality. of sensor inputs **104** for detecting signals representing any of various AOTF parameters, such as light output power, temperature, AOTF identification data, etc. The controller **10**, in response to these detected signals, performs any of various functions. For example, in response to a detected AOTF output wavelength power, the controller **10** seeks to optimize the power output of the AOTF by adjusting a frequency of an RF drive signal from controller port **106** to an AOTF acoustic transducer **22** (FIG. **1**). The AOTF **16** (FIG. **1**) is placed in a control loop with the controller **10**. The information fed back can be any of various parameters including for example optical intensity of a selected wavelength output from the AOTF, a temperature of the AOTF, and/or AOTF device parameter data stored in a EPROM in an AOTF housing, etc. . . . The controller **10** has modulation inputs **108** for application of data to each of one or more wavelengths passed by the AOTF **16**.

A USB bus **110** is provided for input of controller programming data from a computer **42** (FIG. **1**), and for output of monitoring performance data from the controller **10** to the computer **42**. Alternate additional RS232 communication line **94** is shown. FSK and blanking inputs **114** are shown for switching a particular RF frequency for the purpose of selecting or de-selecting a particular wavelength, or selecting any one of a plurality of wavelengths through an AOTF. Other input types than FSK are also included in the present invention for this purpose, and also for the purpose of adjusting the amplitude of a selected wavelength.

Each DDS **116** operates to provide an RF signal to a combiner **118** for output to the AOTF. Filters **120** and modulators **122** are shown in line with each DDS **116** output to the combiner **118** for filtering out unwanted signals/noise and for modulating the signal.

FIG. **5** also shows a custom interface **40** as described in reference to FIG. **4**, showing the RS232 bus **94** and a bus **112** including all other appropriate buses, such as those described in reference to FIG. **4**. The interface **40** is provided with connectors selected to mate with a particular user's hardware, and has programmability for adopting input signals to conform to requirements of the controller.

FIG. 1D shows the daughter board **70** having input connectors **100** and **102**, for example, where the choice of connectors **100** and **102** is specific to the requirements of the user. For example, an interface connector can mate with a specific user's connector for input of signals to the amplitude modulator input line **108** and frequency selection buses **126**. Another connector could be for signals between a computer and a USB transceiver, or to the RS232 transceiver **94**. All of these signals would be altered as required by the interface **40** and sent to the controller. An example of signal modification by the interface **40** would be to perform an A/D conversion for converting a user's analog input signal to a digital signal required by the amplitude modulator **122**. The reverse D/A conversion could also be performed as required. In any situation, the interface **10** is custom configured to provide the proper adaptation from the user to the mother board/controller **10**.

FIG. **5** shows alternate ways of controlling the DDS modules **116**. A computer **42** can input signals via line **110** to the lines **108** and **114** (bus not shown), or it can input signals to the DDS 116 and modulator **122** via the bus **84** to the RS232 module **128**, or it can send directions via bus **84** to bus **112** to the USB module **130** to a DDS module **116**. FIG. **5** also shows a blue tooth module **124** providing a wireless connection for communication with the controller for providing inputs and receiving data.

The controller **10** can also be used for other control functions, such as for controlling other mechanical and/or electrical functions. For example, the controller could direct and/or maintain an AOTF crystal physical orientation through electromechanical apparatus. A positioning system controlled by the controller is symbolically illustrated in FIG. **6**. FIG. **6** illustrates an AOTF **132** upon which is incident a beam **134**. FIG. **6** shows a refracted beam **136** impinging onto a sensor **138**, and an un-refracted beam **140** onto a beam block **142**. A positioning system **144** is symbolically illustrated for orienting/positioning the AOTF **132**. The controller **10** is shown in communication with the positioning system **144**, for positioning the AOTF, for example to adjust the beam **136** onto the sensor **138**. The controller **10** outputs RF through line **146** to the acoustic transducer **148**, and receives a detected/sensed signal through line **150** from the sensor **138**. As discussed above, the AOTF can also have other sensors or data storage attached either directly as in an AOTF housing for providing useful input to the controller **10**. The sketches of AOTFs in FIGS. **1** and **6** are simply given as symbolic representations of an AOTF. The present invention includes use of the controller **10** for controlling any controllable function of any kind of AOTF.

Although preferred embodiments of the present invention have been described above, it will be appreciated that certain modifications or alterations thereon will be apparent to those skilled in the art. It is therefore requested that the appended claims be interpreted as covering all such alterations and modifications that fall within the true spirit and scope of the invention.

What is claimed is:

1. A method for controlling an acousto-optic-tunable filter comprising:

(a) controlling an acousto-optic-tunable filter with a controller, said controlling including determining an optimum RF signal for application to an acousto-optic-tunable filter acoustic transducer for selection of a particular light wavelength, including

(i) scanning a sequence of RF signals defining a first frequency spectrum to said acoustic transducer;

(ii) sensing a light out parameter from said acousto-optic-tunable filter corresponding to each of said RF signals;

(iii) identifying a base frequency corresponding to a most optimum said output parameter and a corresponding RF frequency as a base RF frequency;

(iv) selecting a next narrower frequency spectrum around said base RF frequency and selecting a corresponding next sequence of RF signals;

(v) scanning said next sequence of RF signals to said acoustic transducer; and

(vi) repeating steps ii–v wherein each successive spectrum is more narrow than the previous spectrum until a minimum spectrum is reached, having a base RF frequency as an optimum base frequency to be applied to said acoustic transducer for selection of said particular light wavelength; and

(b) custom interfacing said controller providing inputs to said controller, said interfacing including providing communication with a user's computer.

2. A method as recited in claim **1** wherein said interfacing further includes convening an input modulation signal to a differential analog amplitude modulation signal, for input to said controller for use by said controller in providing modulation of a light signal.

3. A method as recited in claim **1** wherein said interfacing further includes providing frequency shift keying (FSK) to said controller for use by said controller in switching a particular RF frequency for selecting or deselecting a particular light signal.

4. A method as recited in claim **1** wherein said interfacing further includes providing a blanking signal to said controller for use by said controller in selecting and deselecting a particular light signal.

5. A method as recited in claim **1** wherein said interfacing further includes providing an RS232interface to said controller.

6. A method as recited in claim **1** wherein said interfacing further includes providing a **12**C bus interface with said controller.

7. A method as recited in claim **1** wherein said controlling further includes providing performance output data for display.

8. A method of controlling an acousto-optic-tunable filter comprising:

(a) controlling by a controller an acoustic-optic-tunable filter including

(i) scanning a sequence of a plurality of RF signals defining a frequency spectrum to an acoustic transducer of said acousto-optic-tunable filter;

(ii) monitoring an output power of each of a plurality of wavelengths output by said acousto-optic-tunable filter corresponding to said sequence of RF signals; and

(iii) selecting an RF signal frequency corresponding to an optimum output for a wavelength; and

(b) custom interfacing said controller providing inputs to said controller, said interfacing including providing communication with a user's computer.

9. A method as recited in claim **8** wherein said controlling further includes:

(a) monitoring an acousto-optic-tunable filter parameter;

(b) reading an acousto-optic-tunable filter performance data stored in said controller indicating an optimum RF signal frequency for a monitored acousto-optic-tunable filter parameter; and

(c) setting said RF signal to said optimum RF frequency.

10. A method as recited in claim **8** wherein said controlling further includes:

outputting performance data for display on said user's computer monitor.

11. A method as recited in claim **8** wherein said controlling further includes:

modulating a parameter of a said wavelength.

12. An apparatus for controlling an acousto-optic-tunable filter comprising:

(a) a controller for controlling an acousto-optic-tunable filter including apparatus for determining an optimal RF signal for application to an acousto-optical-tunable filter acoustic transducer for selection of a particular light wavelength including

(i) apparatus for scanning a sequence of RF signals defining a first frequency spectrum to said acoustic transducer;

(ii) apparatus for sensing a light output parameter from said acousto-optic-tunable filter corresponding to each of said RF signals;

(iii) apparatus for identifying a base frequency corresponding to a most optimum said output parameter and a corresponding RF frequency as a base RF frequency;

(iv) apparatus for selecting a next narrower frequency spectrum around said RF base frequency and a corresponding next sequence of RF signals;

(v) apparatus for scanning said next sequence of RF signals to said acoustic transducer; and

(vi) apparatus for repeating steps ii-v wherein each successive spectrum is more narrow than a previous spectrum until a minimum spectrum is reached, having a base frequency as an optimum base frequency to be applied to said acoustic transducer for selection of said particular light wavelength; and

(b) apparatus for custom interfacing said controller providing inputs to said controller, said interfacing including providing communication with a user's computer.

13. An apparatus as recited in claim **12** wherein said apparatus for interfacing further includes apparatus for converting an input/modulation signal to a differential analog amplitude modulation signal, for input to said controller for use by said controller in producing modulation of a light signal.

14. An apparatus as recited in claim **12** wherein said apparatus for interfacing further includes an apparatus providing frequency shift keying (FSK) to said controller for use by said controller in switching a particular RF frequency for selecting or deselecting a particular light signal.

15. An apparatus as recited in claim **12** wherein said apparatus for interfacing further includes apparatus for providing a blanking signal to said controller for use by said controller in selecting and deselecting a particular light signal.

16. An apparatus as recited in claim **12** wherein said apparatus for interfacing further includes apparatus for providing an RS232interface to said controller.

17. An apparatus as recited in claim **12** wherein said apparatus for interfacing further includes apparatus for providing a **12**C bus interface with said controller.

18. An apparatus as recited in claim **12** wherein said apparatus for controlling further includes apparatus for providing performance output data for display.

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